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[OFFICIAL NOTICE.]

### New England Association of Gas Engineers.

The next semi-annual meeting and excursion of the members, with their ladies and friends, will be held on the 16th and 17th days of August (to-day and to-morrow) according to the programme published in last issue.

The headquarters of the Association will be at the Bancroft House, New Bedford, Mass.

Officers of gas companies, and gentlemen furnishing supplies and machinery to such companies, are hereby cordially invited to be present at the meeting and excursion.

## THE PITTSBURGH MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

As the time set apart for the meeting of the American Gas Light Association rapidly approaches, we would urge upon the attention of the fraternity the necessity of united effort to make the coming meeting a decided success. The wisdom of holding these annual meetings in the Autumn season is, to our mind, undoubted. The gas manager at this period has completed all the alterations and improvements contemplated in the spring, and is ready for his winter's business. He has before him the results of his past year's working, knows perfectly the troubles which beset him during the twelvemonth, and also distinctly remembers the remedies which he applied to extricate himself from such unpleasant predicaments as the exigencies of his manufacture may have led him into.

Another great advantage is in the fact that he has at his command an opportunity to review the results accomplished in other countries. The proceedings of the annual meetings of the English, French and German Associations are at his disposal, and from them he may learn of the advances that have been attained in his profession in foreign lands. This would seem to us to be an advantage of the greatest importance, and one of sufficient value to prevent the American Association from changing the season of its meeting at any future period. But while the results obtained by foreign manufacturers are, of course, of great moment, it is not to be forgotten that what will be of the greatest interest and importance to the home manufacturer is a thorough knowledge of what is transpiring at home. By what surer means can this knowledge be secured than in meeting together and letting one another know just what has been accomplished by each. It is not at all necessary that great technical knowledge or profound research should be displayed in preparing a paper on any topic which may appear of value to the author. Facts stated plainly and simply bring conviction with them just as forcibly as though they were ornately clad in high-sounding speech; and, of a surety, are more easily digested, and will be all the more tenaciously remembered.

There is one thing in connection with these meetings to which we have often alluded, and which we will now revert to again. The people who should be the most largely interested in the success of associations of this nature appear to be the most backward in contributing material aid and moral support. In our opinion there ought not to be a single gas company in the United States the name of whose engineer does not appear on the roll of membership of the Association, and who should not feel obliged to send a representative to its meetings; for who, in the long run, are more benefited by the workings of the Association than the gas companies themselves. Engineers and superintendents come together and strive to improve their methods of working, by mutual comparison and interchange of ideas, with the ultimate result of increasing their send-out and cheapening its cost—and to whose direct profit do these things most accrue. The answer is plain. The engineer may reap the glory of making the discovery or the advance, as the case may be, but the profit and loss account in the ledger of his company will show where the greatest and most substantial gain has been made. Not only do we claim that gas companies should be eager to send their engineers to these meetings, but also to see that the necessary funds are furnished them wherewith to meet the expenses occasioned by travel.

Another step which we are of the opinion would be an advance in the right direction, would be the establishment of a prize-fund, somewhat similar in

its nature and disposition to that at present maintained by the French society. A reference to the address of M. Charles Foucart, which will be found in another column, will show that the French gas companies contributed in the past year no less a sum than 18,575 francs (about $3,700) towards the encouragement of the purposes for the perfection of which that association strives. It would appear to us that should the American Association see fit to institute a series of prizes for the best papers presented on certain subjects connected with the manufacture of gas, it would result in great benefit. The younger men of the profession might be stimulated to enter into the lists of competition with the older heads, and the outcome of this rivalry would be speedily apparent. The incentive to exertion given by the hope of reward is great, and, at the same time, healthful.

In these times competition in supplying artificial light is sharp and close; and it is the duty of every member of the fraternity to be ever watchful and alert. No plan, however small it may seem, should be neglected in trying to reach the point which lessens cost of manufacture, and its concomitant of reduced price to the consumer. With the price of crude petroleum oil at 52¼ cents per barrel, and with no immediate prospect of any great increase in its value, the gas manufacturer meets with a competitor much more to be feared than all the great army of electrical promoters put together, who, deal with them as fairly as we may, "make haste but slowly"; and whose threats of a speedy extinction of the business of gas manufacture appear really to have but added to the strength of the gas maker's position. Be this as it may, it should be the aim of the gas engineer to advance his profession, and with every advancement comes reward.

The place of meeting is well-chosen, and is easy of access; and of the welcome which will be accorded to those who visit Pittsburgh we need not speak. It is to be hoped and expected that the meeting will be largely attended, and that each one will come prepared to add his quota to the general fund of information. There need be no excuse on the ground of lack of entertaining subjects; but should anyone be in doubt as to what topic would likely be of interest, let him look over the list which has been compiled by the Secretary, and very little difficulty will be experienced in making a selection.

There is no reason whatever why the American Association should not be the foremost of its kind; and such a result depends solely and entirely upon the exertions and efforts of its members. Let us then hope that when the meeting of 1882 shall have been a thing of the past that its records will live long after to bring forth good fruit—and this we are confident is the verdict we shall be called upon to chronicle.

## Gas versus Electric Lighting.

In view of the assertions going the rounds of the Press, as to the great "economy" of using incandescent electric lights for purposes of household illumination, the following letter, to the London *Metropolitan*, from H. Saxon Snell, F.R.I.B.A., will be of interest. Mr. Snell has studied the question very closely, and his statements are not those of bare assertion, but are the deductions drawn from actual comparisons of cost. The letter is as follows:

To the Editor of the *Metropolitan*:

Many hundreds of thousands of pounds have lately been invested in electric light companies upon the faith of statements made in prospectuses that the mode of lighting is as cheap, if not cheaper, than that by gas. As to public buildings, we are told that "the difference between the cost of gas and electricity, light for light, is largely in favor of electric light, as proved by the Brush arc system at South Kensington (a saving of £325 16s. 4d. having been effected during the nine months as compared with gas)." Then Sir William Thompson is stated to have "had his house fitted with incandescent lamps from cellar to attic to the entire banishment of gas, and the cost of internal *wires* for electric lamps is less than the cost of fittings in connection with gas pipes." Lastly, we have the statement of Mr. William Crookes, F.R.S., and director of the Gulcher Electric Light Company, that he has fitted up two rooms in his private house with electric lamps, and has effected a saving of £4 17s. 6d. per annum as compared with gas lights.

No wonder, then, that one of my clients, a public Board, deemed it its duty to ascertain the cost of lighting by electricity one of the large institutions under its control. It instructed me to obtain estimates, and accordingly I applied to three of the most important electric light companies for specifications and tenders for lighting the building in question, merely stipulating that the work should be executed under the same general conditions as those employed in the contract for the supply of gas pipes and fittings.

In the result, three tenders were received for the execution of the works, amounting respectively to £5,500, £4,345, and £3,143.

It then became my duty to make an estimate of what would be the annual cost of lighting the building, supposing one or the other of these tenders to be accepted, and I did so as follows from one furnished me by one of the companies in question, though I thought it my duty to inform my client that I considered many of these items to be considerably underrated.

| | No. 1. £. s. d. | No. 2. £. s. d. | No. 3. £. s. d. |
|---|---|---|---|
| Interest on first outlay at 5 per cent.. | 275 0 0 | 217 5 0 | 157 3 0 |
| Depreciation of plant and general repairs at 10 per cent..... | 550 0 0 | 434 10 0 | 314 6 0 |
| Coals—say 8 tons per day, at 20s. per ton delivered..... | 730 0 0 | 730 0 0 | 730 0 0 |
| Oil, waste, etc..... | 52 0 0 | 52 0 0 | 52 0 0 |
| Wages, 2 engineers at £2 per week.... | 208 0 0 | 208 0 0 | 208 0 0 |
| " 2 assistants at 30 shillings..... | 156 0 0 | 156 0 0 | 156 0 0 |
| Renewal of lamps after first year, not including accidental breakage, but assuming the average life of a lamp to be 1000 hours, and that the average time of lighting would be 5½ hours daily..... | 475 0 0 | 475 0 0 | 475 0 0 |
| Total..... | 2,446 0 0 | 2,272 15 0 | 2,092 9 0 |

As I was anxious that my report should as far as possible be incapable of question, I sent a copy of each of these estimates to the respective companies, with a request that they would point out any errors they might conceive to exist, and in reply they sent me their revisals, which resulted in the following estimates for the annual expense—viz., £2,394, £1,905, and £2,000, as against my own of £2,446, £2,272, and £2,092 respectively. These reductions were made in various ways, some conceiving 4 per cent. for interest on outlay, and an average of 5 per cent. only for depreciation and repairs, to be a sufficient allowance.

It now became necessary to calculate the corresponding cost of gas lighting. The total outlay for fitting up the building in question with gas pipes, burners, meters, and all other appliances, had been £906. The annual cost of gas consumed, exclusive of that consumed in a cooking apparatus, was £738, but more than one manufacturer has offered to supply regulators (there are none at present), and to guarantee a reduction in the consumption of 20 per cent., failing which no claim would be made for payment. Moreover, I have lately had the meters, from the records of which the above amount is computed, tested by a Government official, and he reports, as to three or four of them, that they register three and four per cent. more than the actual consumption. But neglecting these important considerations, and assuming the consumption to continue now as in the past, we find the annual cost of the gas lighting to be as follows:

| | |
|---|---|
| Interest as before on first outlay (£906) at 5 per cent.. | £45 6 0 |
| Depreciation of plant and general repairs as before at 10 per cent..... | 90 12 0 |
| Annual cost of gas actually used in the past..... | 738 0 0 |
| Total..... | £873 18 0 |

Now observe how the matter would stand supposing that the lowest tender (No. 3, £3,143) for the electric lighting appliances were accepted, and that in the execution of the works no extra expenses were found to be necessary, assume also that the corresponding estimate, £2,000, *made by the company itself* for the annual cost of lighting to be the right one, and we have—

| | Gas Lighting. | Electric Lighting. |
|---|---|---|
| Cost of all appliances..... | £906 | £3,143 |
| Annual cost of lighting..... | £874 | £2,000 |

These estimates ignore the fact that even though the electric light were adopted, it would still be necessary to retain and use the present gas fittings because the majority of the rooms and corridors of the institution in question from the nature of their use require to be lighted with a subdued light during the whole of the night. It would clearly not be fair to calculate that the electric light machinery would be working all the time to supply this comparatively small demand, neither does it take into consideration the very important fact that the gas burners give greatly-increased warmth to the rooms in which they are placed, and that, therefore, in the absence of these appliances, a much larger consumption of coals for heating purposes would necessarily result.

This inquiry was entered into by me without the slightest prejudice in favor of either system, and in entire ignorance of their relative monetary values; but the information I have gathered during the course of my investigation results in a strong conviction that if the statements before referred to as to the economy of gas lighting in private houses were submitted to similar impartial tests they would be shown to be fallacious. Further, I have no hesitation in saying that if only a tithe of the scientific labor now devoted to the improvement of electric lighting apparatus were expended upon discovering methods for improving the construction of gas lamps in closed rooms, the superiority of gas as a lighting agent in such situations would be shown to be paramount. I do not hazard an opinion as to the relative advan-

tages of the two systems when employed to light railway stations or other such like open spaces.

Mr. Crookes says that with the use of gas "the ceilings get blackened, the curtains are soiled with soot and smoke, the decorative paint work is destroyed, the gildings tarnished, the bindings of the books rotted, and the air of the room is not cool and fresh, but vitiated by the hot fumes from burnt or semi-burnt gas." But surely he must be aware that these ills do not attain where proper apparatus, such as "Rickett's ventilating gas globe lights," "Siemen's regenerative gas burners," or the ordinary "sunlights" are employed for lighting up rooms. These appliances, when in use, carry off into the outer air not only the products of combustion, but they also act as powerful ventilators by drawing away foul air from the upper parts of the rooms in which they are placed, air which would stagnate there were these lamps to be replaced by electric lights; and it is, therefore, to the improvement of this class of apparatus so as to moderate their present prices that I would, as a corollary to my investigation, commend the attention of our scientists and mechanicians.

## The Petroleum Outlook.

The situation since our last issue has undergone considerable change. In the Warren field which is the center of all attention at present, the belt has been reasonably defined so far as width is concerned, by two dry-holes on the western side on lot No. 648 and on lot 633; and by two small wells on the eastern side of lot No. 659, with the outside limits thus defined the belt in the neighborhood of lot 646 is a little less than a mile in width. The northern end of the belt seems to be accepted as reasonably defined by a dry hole on lot 590. There is nothing, however, in the southern or south-western direction to indicate a limit, as the Goldsboro well, on lot 672, which is the furthest in this location, is doing about 500 bbls.

The new Warren field is altogether unprecedented in its development so far. Every well on the belt comes in large, and considering the proximity of the vicinity of 646, all the wells hold up their production as a like number of wells never did before. The field is but little over two months old, and the daily production has already reached about 17,000 barrels. This will in all probability be rapidly augmented by the new wells daily coming in. The skill with which operations are conducted in this field is almost marvelous; wells are drilled in some instances in as short a time as 17 days.

By reference to our tables of runs and shipments for the past four months, it will be seen that the runs have averaged up to the month nearly 90,000 barrels daily; and that the runs of last month were over 95,000 barrels daily. Our daily average production for last month reached over 94,000 barrels, which has never before been equaled; but from present appearances and prospects, our daily production will probably exceed 100,000 barrels.

Under these circumstances, it is almost certain, that we will be obliged to continue to add largely to our stocks in the region for many months to come.

The stock in Europe, from our latest advices, is something over a million of barrels of refined, more than it was this time last year, we can thus not reasonably expect a continuance of heavy exports for the balance of the year; and already the export trade has begun to fall below what was lately the general expectation.

In the Bradford and Richburg fields, new operations are very few; but the production of these fields, coming as it does from a great number of small wells, declines slowly; and the decline will, for some time, be far more than overcome by the rich flows of the Warren wells.

Altogether we see no ground in the statistics of the business to hope for any substantial improvement in prices for some time to come.

*Addenda*, July 24th.—Within the past four days (since writing our estimate of the outlook) the Warren field has undergone a still greater change almost phenomenal. The wells seem to be falling off quite rapidly, while the best of the new ones are coming in small, while some four or five new dry holes are added to the list. Altogether, the field seems to be waning almost as wonderfully as it "opened up." The sand proves to be only about 25 feet thick, and in the latest wells shows signs of having been drained by the older wells.

On the whole, we are somewhat inclined from these developments of the past few days, to modify our views of the prospective market.

## Electric Lighting in Cleveland, Ohio.

The following interview between a Cleveland *Daily Herald* reporter, on Tuesday, August 2d, and City Auditor Ford, speaks for itself—

"I have a little matter which the public should know," said City Auditor Ford to a *Herald* reporter yesterday, as the latter stepped into his office. "It was called to my attention by the statements of certain Councilmen, during debate, that the market fund had been unnecessarily depleted to extend the electric lights out Euclid avenue. The Brush Electric Light and Power Company did a very neat thing in getting the city to pay the cost of an experiment."

"In what respect?" asked the reporter.

"I have investigated and made up a statement covering the subject," said Mr. Ford, "and the figures show for themselves. The cost for lighting Euclid avenue with the electric lights will be over four times the amount formerly expended for gas. For the months of July, August, September, October and November the number of hours down in the time-table is 1,011. Now, the cost of thirty-three electric lights for 1,011 hours at 6½ cents per hour is $2,168.59. The cost of gas to sixty lamps (the number formerly used on Euclid avenue from Bond street to Wilson avenue) the same number of hours at $1.25 per 1,000 cubic feet of gas is $341.21. Add to that the cost of lighting and caring for sixty gas lamps for five months $125, giving a total expense for gas lamps of $466.21. Hence the cost of electric lights over gas for five months is $1,602.38."

"Again," continued the City Auditor, "the cost to the city of fitting up the electric lights on Euclid avenue was, as per bills rendered, $873.57; so we find that the cost of the experiment to the city over lighting with gas as formerly is just $2,475.95."

"But Euclid avenue was miserably lighted with sixty lamps was it not?" asked the reporter.

"The light was certainly weak," returned Auditor Ford, "but the city could have placed three times as many gas lamps on the avenue and still saved a margin." The City Auditor has probably called out an interesting discussion.

## Apparatus for Liquefying Ammonia Gas.

Mr. Reynolds has lately described the following apparatus which has for object the liquefaction of ammonia gas.

This apparatus consits of a U-shaped tube made of gas pipe, the side tubes being about 4½ inches internal diameter, and the bottom pipe from 2 to 2½ inches in diameter. One of the sides is 15½ inches long and the other about 12. The bottom piece is somewhat over 9½ inches long, and is screwed firmly at its end into caps on the lower ends of the side tubes. The upper end of the shorter side is provided with a cap fitted to support a glass Cailletet tube, the capillary portion of which rises above its top. The upper end of the longer side is also furnished with a cap. The Cailletet tube having been filled with pure dry ammonia gas, is immersed in the mercury with which the apparatus is filled, and the cap is screwed on. Mercury is then removed from the longer leg, leaving a space of about 4½ inches between the metal and the cap. This space is filled with a concentrated solution of ammonia, and the cap is firmly screwed on. The application of heat liberates the ammonia gas, which exerts pressure upon the mercury, and so compresses the gas in a Cailletet tube until finally liquefaction sets in and the layer of the liquefied gas appears in the capillary portion of the tube. On cooling, the gas is reabsorbed.

## Americana.

A certain young maid named Mariah
Conceived a tremendous desiah
To try her own plan
With a coal-oil can
In augmenting the blaze of the fiah.

The result wasn't what she intended,
And the stove now will have to be mended;
For something exploded—
Didn't know it was loaded.
The funeral was largely intended.

—Baltimore *American*.

## New Gas Company in Columbus, Ohio.

It is currently reported that Mr. H. S. Jackson, who is believed to represent a company of New York and Philadelphia capitalists has for some time past been engaged in talking up a new gas company for Columbus, Ohio. In fact an ordinance has been introduced in the City Council of that place, by a Mr. Nelson, to grant Jackson and his associates the privilege of laying mains, etc., for the purpose of supplying illuminating gas to the corporation and to the citizens.

It is proposed, we believe, to employ the Lowe patents, and the usual inducements of reduced price and high illuminating power are advanced.

Electric Light at Providence.—The Providence, R. I., authorities lately passed a resolution empowering the lamp committee to enter into a contract for erecting and maintaining ten electric lights for a period of six months, the price not to exceed 85 cents per light per night.

[From the London "Journal of Gas Lighting."]

## Experience with Generator Furnaces.

A paper read by Mr. William A. Valon, A.I.C.E., at the meeting of the Gas Institute, Birmingham, England, Wednesday, June 14, 1882, with the discussion thereon.

Within the last two years three valuable papers upon generator furnaces have been read before the Institute. Nevertheless, I need not apologize for bringing the matter again before you, because I believe there is much still left to be said with advantage, and because I think I may supply, to a limited extent, a few facts that will be of service. In treating the subject I propose to state as briefly as possible my reasons for faith in the generator furnace; to describe the particular modification I have adopted; to point out the further modification in the form of construction my experience has dictated; to give you, in plain figures, the results of six months' working with twelve furnaces; and, leaving you to draw your own inferences from the statements, I shall, with all deference to your judgment, present the conclusions I have come to.

I will commence by remarking that my attention was first arrested in May, 1878, by the regenerator system in use at the Paris Gas Works, into the working of which I was very kindly initiated by Mr. Arson, through the interpretation of our Secretary, Mr. W. H. Bennett. Here I saw something that was entirely new to me, and for the first time followed the construction of a gas furnace on the regenerator principle of Dr. Siemens. My first examination led me to a second, and upon coming back I returned to the subject again and again, until firmly fixed in the opinion that the regenerator furnace was the probable one of the future. My primary reasons for this conclusion were from what was evident to the senses—without any regard as to economy of fuel, of which I knew nothing—viz., the evident saving in labor, the doing away with the laborious system of clinkering, the easy mode of charging, and the saving of heat by keeping a furnace so nearly and constantly full. These I thought sufficient reasons for their adoption, even should the original cost of their construction prove considerably more than the ordinary furnace. Consequently I set about making inquiries, and as closely as possible inspecting the different forms of furnaces in use. I was, however, unable to fix my mind as to the one best suited to my purpose, having regard, not to the saving of fuel only, but to the aggregate advantages, embracing economy in construction, ready adaptation, effective carbonization, with a minimum of labor, and as little wear and tear as possible.

In 1880 regenerator furnaces were first used at the Maidstone Gas Works. I had several opportunities of seeing them during their construction, and afterward watching them while in use; and I have since compared notes with my friend Mr. H. Smythe. About this time I visited the South Metropolitan Gas Works, and there saw what I believe to be the foundation of a simple, good, and cheap generator; and, upon further examination of its construction, I resolved, without hesitation, to introduce it at Ramsgate, and give it a fair trial. I have done so, with what success you will be able to judge by the results I am about to lay before you of six winter months' complete and continued carbonization by means of these furnaces, which are still in exclusive use.

It would perhaps be well here to give some idea of the construction of the furnace as shown in the diagrams, which have been prepared by my assistant, Mr. Charles Bennett, for the purpose of illustrating my remarks; for, although most of you will be intimate with its form from its appearance in the *Journal of Gas Lighting*, and also in King's "Treatise on Coal Gas," there may be some who have not yet seen it.

The diagrams numbered 1 show the construction of the furnace originally in use, those numbered 2 being substantially the same, with such suggested alterations as I think are improvements. As will be seen, the first absolute necessity for a furnace of this kind is sufficient depth below the firing floor for the free working of the men in keeping the slot clear; and this can only be done efficiently and in comfort by carrying the retorts on an arch. With this exception the construction of the furnace is exceedingly cheap and simple. Indeed, it is as nearly as possible a copy of the old form of furnace, save that it is deeper, and instead of furnace bars being used an iron box is built in for the purpose of admitting air for primary combustion. The size of the furnace from the top of the box to the springing of the arch is 4 ft. 6 in., the extreme length 6 ft. 10 in., contracting until it reaches the slot, where it measures 2 ft. 7 in., and the width 1 ft. 5 in., thus giving a firing space of about 36 cubic feet. The furnace frame built into the front is, of course, air tight, having a ground face upon which the lid rests. The pipes, which are of cast iron, are built in the side, and measure 9 in. by 3 in., and have a length of about 17 ft. 6 in. Thus the air has to travel over a superficial area of 35 square feet on each side of the furnace. They are protected with 4½-inch brickwork; the whole of the bricks coming in direct contact with the heat being red Epsom. These pipes, as will be seen, are carried to a point immediately below the springing of the arch, at which point holes are left for the discharge of heated air on the top of the furnace. The ends of these pipes showing through the arch at the bottom are furnished with a thin iron plate for the purpose of regulating the supply of air.

In two of the settings the air channels have been constructed of brick instead of iron, which, of course, is much cheaper, more durable, and, as far as my experience goes, equally effective. A steam pipe was also provided for the purpose of keeping the slot cool. But as this was found altogether unnecessary it was soon discarded, the point of combustion by its use being carried too far up the furnace, so that, instead of the slag running freely, clinker rapidly formed. This furnace heats a bed of seven retorts 16 in. by 22 in. by 10 ft., the arch itself having an area of 656 cubic feet. The arch on which the furnace is built is composed of Newcastle fire-bricks, the leveling up from the crown of the arch to the bottom of the flue of the lower retorts being Stourbridge.

Before proceeding to say anything of diagrams No. 2, I should like to give you a little of my experience when the furnaces constructed on the form just described were brought into use. To prevent explosion when first lighted, care was taken to ignite the gas as made. This was tried first by introducing into the furnace chamber a perforated pipe having gas jets lighted; but in a short time the heat destroyed the pipe by which the gas was conveyed. Eventually I decided upon leaving the door open until the arch and its surroundings were sufficiently heated to fire the carbonic oxide, and relieve us of any danger. As may be imagined, however, our greatest difficulty was the regulation of the draught both for primary and secondary combustion; and this could only be done by carefully feeling our way. The result was that the heats were sometimes "up" and at other times "down;" and although I will give you presently the area of the openings for both primary and secondary combustion, the figures will not be any guide, except in cases where the conditions are identical. But careful experiment will determine this in a short time to anyone using them. What I mean by this is that the height and area of the shaft and the number of beds attached to it will influence the draught required so greatly that the area sufficient for mine would probably not be so for others, owing to the absence of the same conditions, or *vice versa*.

The opening of the slot through which air enters for primary combustion measures 2 ft. 6 in. by 2 in., and, of course, remains constant in area. The inlets of the air pipes were originally 9 in. by 3 in., one on each side of the bed. But I found that never more than 3 in. by 3 in. was needed, and sometimes only 1½ in. by 3 in.; the quantity of fresh air supplied varying according to the direction in which the wind was blowing. Each bed is connected to a separate shaft 12. in. by 12 in. internal diameter and 36 feet high. Brickwork is used to a height of 18 feet, the remainder being a charcoal iron pipe.

Here I may remark that the use of a separate shaft is highly advantageous in working this class of furnace, seeing that once having ascertained the necessary quantity of air required for one bed (and the damper set accordingly), the dampers of the others may be similarly adjusted; nor is their re-adjustment necessary when lighting up or letting down a setting, which would be the case where more than one bed is attached to a single shaft. The cost of these shafts, I may add, is less than where a large horizontal flue has to be constructed leading to a single shaft of sufficient dimensions to take the whole of the waste gases from a number of furnaces. The damper opening that each shaft required was 6 in. by 12 in., or 72 square inches.

After balancing our dampers everything proceeded satisfactorily for a time, but in about three weeks the heat began gradually to diminish, and we thought of and tried many things before we discovered the cause. For as, on giving the beds the whole of the reserve damper, a certain improvement resulted, I came to the conclusion that a stoppage had occurred somewhere; and this, indeed, was the fact. An examination of the flues showed them to be completely choked in the short time named (three weeks). As soon as cleared, the damper space was closed to one-half its extent; and all went well until the operation had to be repeated. I am now prepared to overcome the difficulty; and this, indeed, was our greatest, seeing it was one altogether unlooked for, my notion being that with generator furnaces flue cleaning would be at an end.

The furnace is fed from the firing floor at intervals of not more than an hour and a half; so that the door may not be open too long at a time, and so as not to allow the fuel to burn too low down. Otherwise the efficient action of the generator would for a time, to a certain extent, be destroyed; and the bulk of the heat would be retained in the furnace, instead of being distributed amongst the retorts. Care should also be taken to well rake the fire forward every 12 hours, or else an accumulation of black non-conducting material will form on the back wall to the depth of several inches. If allowed to remain, this will gather clinker too high up the furnace to be reached by the man below, and lead to inconvenience. I mentioned that the use of the steam pipe was discontinued, the man below having no difficulty in keeping the slot clear. But attention is needed,

I may now, I think, refer to diagrams No. 2, and point out the one or two simple additions which I consider will be found improvements, and will have suggested themselves from what I have already said. The choking of the flues, as I have stated, was a great source of trouble when we first started. After blowing out a furnace, the floor of the retort house appeared as if covered with snow; and on the removal of the front wall of one of the beds for examination, the interior appeared as if whitewashed. Suitable sight-holes should therefore be furnished at each side of the furnace, and on every horizontal flue throughout the bed, to enable them to be examined at all times, and cleared periodically and expeditiously. Another use to be made of the sight-hole is, in case of any doubt existing as to proper combustion, the plug can be removed and one covered with talc substituted. The action of the fire can thus be seen. With this exception I know of no reliable test whereby it can be determined whether the furnace is doing its duty. If too much air is admitted through the secondary chambers, the strong air travels but a comparatively short distance before becoming attenuated, and the power is destroyed before reaching the vertical down flues. If not air enough, black unconsumed smoke will be found under the bottom retort instead of a clear flame.

The air channels, too, should be easy of access for clearing purposes; for although they do not choke so fast as the flues, they do so in time from the fact that there is a free draught through them (when clear), which draws in rapidly the fine fliers from the quenched coke, the dust from the raking of the furnace, etc. By the arrangement shown in the diagram (which we have already in use), inspection can be made at any time, and when desired the temperature of the air just before entering the furnace can be ascertained.

I may at once say that our experience is that fire-brick channels are the best, and the objection urged against them that they do not remain sound has not been verified in our case. On the contrary, they give every satisfaction, while in each instance the iron pipes, at the point where the air enters the furnace, were much burned, and in some instances nearly destroyed. Below that point they were in fair order, with one exception—viz., where some inferior bricks had fused and exposed the iron to the direct action of the heat, necessitating the removal of the entire pipe. Had it been a brick channel, the repair would have been comparatively trifling. We have formed our channels with specially made rabbeted bricks, the bottom and top ones extending from the side of the furnace to the side of the retort. The joints are all broken, and dovetailed one into the other, so that none are straight, either vertically or longitudinally. I am so convinced of the soundness of channels thus constructed that I shall have no hesitation whatever in forming additional ones below the bottom retorts, returned into those alongside of the furnace, as shown in the diagram. The air in this case would be admitted at the point marked A, return under the same retort, and travel along the channel at the side of the furnace as at present. The superficial area for the air so traveling before being discharged into the furnace would be thereby increased 35 feet. Again, provision having been made in the shape of sight-holes, the channels can at any time be tested for soundness by simply closing the shaft damper for a few moments, when, should an opening exist, it will declare itself by the products of combustion being forced through into the channel, where the cracks, if any, can be seen and stopped with facility. I would further suggest that the air should be discharged into each nostril hole of the arch, to ensure a more perfect mixture of heated air with the carbonic oxide, and at the same time carry the point of secondary combustion higher up amongst the retorts. I notice that a similar plan has been suggested by Mr. Somerville, only he proposes to take the air-discharge nostril right through the arch.

Here I may remark that, after writing the foregoing, another plan of Mr. Somerville's, published in the *Journal of Gas Lighting*, attracted my attention, in which the pipes are proposed to be taken through the main flue at the bottom of the bed. Appealing as it did, to my mind, as a much more perfect theory, I was induced to reconsider what I had written, with the view of seeing if the conditions I had already arrived at would be affected; but, on the contrary, I feel so convinced, from past experience, that wherever pipes or channels are placed they may soon become stopped, and should therefore at all times be made accessible, that I resolved to let my remarks stand.

You will also observe that we have inserted under each slot a cast iron box, 3 ft. by 2 ft. by 9 in., which is kept charged with water. Into this the breeze and slag fall, and are instantly quenched, adding greatly to the comfort of the men. It also keeps the surroundings cool—the water evaporating and passing into the furnace as from an ordinary ash pan. The temperature of the furnaces and waste gases I have had no opportunity of ascertaining, for want of being able to procure suitable and reliable apparatus, I have, however, by means of Bailey's pyrometer, ascertained the temperature of the secondary air supply just before being discharged on the top of the furnace, which a series of tests has proved to be between 1,150° and 1,200 degrees Fahrenheit.

*Cost of Furnaces.*

| | | | |
|---|---|---|---|
| Material, including rabbeted bricks, door frames, and other ironwork | £7 | 10 | 0 |
| Labor for building furnace after lower arch is formed | 2 | 10 | 0 |
| Total | £10 | 0 | 0 |

When iron pipes are used, the *additional* cost would be £7 10s. per furnace.

As far as my experience goes, these furnaces will require repairing once during the lifetime of the retorts, at a cost of about £5; making, where brick channels are used, a total cost of £15 per furnace for burning out each bed of retorts.

In constructing any additional furnaces, I should prefer that their depth should be increased at least 1 foot, making it 5 ft. 6 in. instead of 4 ft. 6 in.; that the iron slot at the bottom be 6 in. longer and slightly wider, to diminish the intensity of the draught as much as practicable; that the back, front, and sides of the furnace should have no sets-off on which clinker could form and adhere, but should slope evenly to the bottom, as shown in diagrams numbered 2; and that all parts underneath the slot subject to wear and tear should be protected by iron plates.

The following are the results for the half year ending March, 1882:

| | |
|---|---|
| Coal carbonized— | |
| Newcastle (Pelaw Main) | 5,457 tons. |
| Cannel | 50 " |
| Total | 5,507 tons. |
| Percentage of cannel used | 0.908, or under 1 p. c. |
| Coke made (at one chaldron per ton) | 5,507 chaldrons. |
| Coke sold | 4,693 " |
| Coke used for fuel | 814 " |
| Coke used (per cent. on make) | 14.78 " |
| Weight of fuel used per hundredweight of coal carbonized, taking each ton to have produced 13 cwt. of coke | 10.76 lbs. |
| Gas made per ton of coal carbonized | 10,575 cubic feet. |
| Unaccounted-for gas | 8 per cent. |
| Average illuminating power | 15.2 candles. |

During the half year many working tests were made to ascertain the fuel used; but in no instance did we obtain anything so favorable as the whole half year's return has shown. The average of a number of trials was 17.95 per cent. by actual measure, or say 18 per cent., which equals, at 13 cwt. per chaldron, 13.16 lbs. of coke for every hundredweight of coal carbonized; thus proving that we made either more than a chaldron of 13 cwt. to the ton, or sold our coke extremely well. Our accountant, Mr. Alfred Lass, gives me as fuel used for every 1,000 cubic feet made during the year ending March, 1881, 35 lbs.; for the year ending March 25, 1882, 24 lbs. This very favorable comparison of the two years is attributable to two causes—viz., the ordinary furnaces (of the old retort house) in the latter part of 1881 being somewhat out of repair, consequent on running them longer than usual while waiting for the new house, and to the saving effected by the use of the generator furnace for seven months ending March, 1882.

Although these figures are stated as they stand in the books, I do not give the whole credit to the furnaces. Our works are quite new; the tar is removed from the gas while hot; and some other general arrangements should, I think, take some credit. I may also mention that we are using West's stoking machine, which spreads the coal in an even layer in the retorts, in a rather shorter space of time than the ordinary scoop. Here I would anticipate a question that is certain to suggest itself to some of you—viz., why I still use 6-hour charges with these furnaces. I have tried both 4-hour and 5-hour work, and am convinced that the results, taken as a whole, when working with 6-hour charges are by far the best. I do not think fierce heat means economy in fuel, and certainly it leads to innumerable evils of one kind and another, only too well known to all of us to need description. In this I do not wish to be misunderstood. I draw the line at good heats; that is to say, the most suitable which my experience dictates for distilling, with the aggregate advantages, the coal I am using.

The conclusions arrived at in my mind with regard to this form of furnace I will state as briefly as I can:

Firstly, the furnace as shown in the diagrams, I think, fairly meets the general demands of carbonization in small, medium, or large works.

Secondly, the heat can be raised or lowered at will to meet the difference in the weight of coal and the duration of the charges, whether 4, 5, or 6 hour.

Thirdly, they can be kept back, "dropped," or "picked up" as easily as an ordinary open coke fire.

Fourthly, they are economical in construction, the repairs can be easily and cheaply accomplished without interference with the retort settings, and when necessary the retorts can be reset with but slight disturbance of the furnace; moreover, they have the advantage of being contained in the same arch with the retorts.

Fifthly, they require a minimum of attention after once being fairly started; one man below attending to 14 fires—the stokers, of course, feeding them above.

Sixthly, they give fair results in economy of fuel.

Seventhly, when once understood, these furnaces will cause less trouble and anxiety than the old form of coke fire.

Much has yet to be done in improving and developing the use of gaseous fuel for heating our retorts. I may be wrong, but I do not attach so much importance to regeneration or recuperation as to generation, the more so as systems of regeneration are undoubtedly very costly; nor do I see how, constructively, they can be anything else. My opinion is that we should endeavor to get as near as we can to the practical conversion of the known quantity of atmospheric oxygen into its equivalent of carbonic acid when burned with carbonic oxide. This my experience has shown me can safely be arrived at without raising the secondary air supply above boiling point. I do not say that it is not desirable to retain as much of the waste heat as possible. I think it is: but I am of opinion that the fuel saved by the particular system adopted should at any rate be sufficient to pay an interest on and return of the capital outlay for its adoption; but the additional saving in fuel, as far as I can ascertain, between generation and regeneration is not large, even when a very high heat is maintained.

Now, I have already said that fierce heat is not economy in fuel; but I will go further, and give it as my opinion that extravagance in fuel is better economy than extravagance in heat, necessitating as it does the enlargement of all carbonizing apparatus, the use of a greater quantity of cannel, increased purification, additional labor, and more wear and tear, to give in return a yield of only a few cubic feet of inferior gas, which would be infinitely better and cheaper left in the coke.

### DISCUSSION.

Mr. W. Carr (Halifax) wished to ask this question of any gentleman who had had experience of generator furnaces: What was the cost of the different furnaces, reduced to a given datum, say per mouthpiece? He gathered from what Mr. Valon had said that his cost of making and repairing would be about 45s. per mouthpiece, which he understood to be for the furnace only, not including anything for the lower arch, or the plating which he had to put there for the convenience of the firemen and the protection of the basis of the retort house. Of course, in reckoning the cost, one would only have to calculate the interest on the outlay. He was much obliged to Mr. Valon for having given to the members, in so plain and understandable a form, the results of his experience. With regard to the question of regenerator furnaces, he might mention that some of the systems which had been adopted were excessively costly, so much so as to be almost prohibitory. One day in the previous week he was at Haslingden, and saw that an effort was being made there to adopt a regenerative furnace which did not require a pit, but might be worked from the ordinary retort house floor. The ashpit was sunk to a depth of 2 or 3 feet below the floor, which could be easily covered with a piece of sheet iron during the time of drawing and charging. That was all the difference externally between the regenerative furnace adopted there and the old furnace. It had only been tried for a short time, and it was yet a question whether it would be successful or not; but, so far as appearances went, there was every sign of its being so. Of course this was a step in the direction of greater economy with regard to putting in these furnaces, which was now generally admitted to be the right plan, where they could be adopted at a reasonable cost. In some cases it was difficult to get permission to spend large sums of money in altering a retort house, and where it was necessary to make the whole of the excavations for deep wells and arches underneath it would mean a considerable outlay. He hoped those who had had experience would, as far as possible, point out the difference, with regard to cost, in the different settings they had tried.

Mr. G. Ernest Stevenson (Peterborough) congratulated Mr. Valon on having had an opportunity, which had hitherto been denied to himself, of bringing before the Institute the results of practical working of the generator system for a considerable time on a sufficiently large scale. He took credit to himself for having done something toward creating a stimulus in this direction, having at the last meeting, at Birmingham, demonstrated the theoretical value of the regenerative principle of heating. The President, in his inaugural address, exhorted the members not to despise theory, but to prove it by practice; and in the results Mr. Valon had now brought forward this suggestion had to some extent been carried out. There was theory put into practice, and practice had proved to some extent the value of theory. It would be ungrateful to pull the paper to pieces; but he must refer to one or two points in which he thought the statements made required a little correction, or else they might be misleading. First of all with regard to the fuel account. Mr. Valon had said that the coke used was 14.78 per cent. of the make; and further on he stated that the average of a number of trials was 17.95 per cent. by actual measure, or say 18 per cent. (equal to 13 cwt. per chaldron), or 13.16 lbs of coke for every hundredweight of coal carbonized, which showed either a great saving in fuel or an improvement in the sale of coke. He was afraid the chief benefit in this account was to be attributed to selling the coke extremely well. He had just had an opportunity of referring to a statement of the working of the Metropolitan gas companies for the past year, and he saw that the average quantity of coke produced was put down at 43.18 bushels. He understood that by the new weights and measures act, by the use of the striked bushel, as much as 48 bushels were produced per ton of Newcastle coal; but Mr. Valon had evidently reckoned out his fuel account on the basis of producing a chaldron of coke per ton of coal. He took the coke sold during the year, which amounted to 4,693 chaldrons, and he estimated the production at a chaldron per ton, which was 36 bushels, and then he said the balance was the fuel account. He feared there was a mistake there; 4,693 chaldrons worked out to about 30 bushels per ton of coal, and if they took only 40 bushels as the average production per ton it would make the fuel account one-fourth of the coke produced, or 25 per cent., equal to about 20 lbs. of coke per 100 lbs. of coal carbonized; and this he took to be the correct result. He was convinced from what he had read, and from his experience of generator firing, that with a furnace of this description (which was an elementary description, for there was practically no regeneration in it) it was impossible to work with such a small percentage of fuel as Mr. Valon thought had been the case. With regard to the question of heat, Mr. Valon did not think it desirable to go to a greater extent in the heating of retorts. He himself did not advocate excessive heating, but his idea of a suitable heat was a higher one than Mr. Valon's. Mr. Valon had not stated in his paper the quantity of coal charged into the retorts daily, and the production per mouthpiece; but he had given him (Mr. Stevenson) the figures, from which it appeared that he charged 3 cwt. of coal into each retort, and the charge lasted 6 hours, which, for 7 retorts, was 4 tons 4 cwt., and the production was about 6,000 cubic feet of gas per mouthpiece. It was not necessary to use regenerative firing to obtain this result, for there were many works in the Kingdom carbonizing as much coal in the time, and producing as much gas per mouthpiece per day with ordinary furnaces; and he believed in such cases the fuel account was equally low with that of Mr. Valon. There was one works in the suburbs of London where the fuel account was remarkably low, yet they were using an ordinary type of furnace, which was introduced many years ago, and it worked out at the end of the year to 9 per cent. of the coke produced. He did not agree with Mr. Valon that with regenerative firing it was necessary to stop at that degree of heat which corresponded with the production of 6,000 feet of gas per mouthpiece and 6-hour charges. Mr. Valon remarked that to carry out the full principle of regeneration was very expensive; but this he (Mr. Stevenson) could not admit. He admitted that the expense was greater per retort, or per setting, with the fully developed regenerative system than with the ordinary furnace; but, as he had said before, if the furnace were properly used the results were such that there was economy in the end. Supposing, instead of producing 6,000 feet per mouthpiece per diem, Mr. Valon produced (which he might do with a more completely developed furnace) 9,000 feet, charging with 3 cwt. in the retorts, and allowing it to remain only 4 hours instead of 6, he would then only require two-thirds of the number of retorts to produce the same quantity of gas, and a retort house of two-thirds the size. Now the cost of the regenerative furnaces was certainly not more than one-third extra; therefore the expense of the retorts and settings would be equal in proportion to the work done, and a considerable saving would be effected in the space, and also in the working, because, there being only two-thirds the number to charge, the wages would be reduced, not absolutely in the same proportion, but very nearly so. He thought Mr. Valon had in this furnace introduced one improvement on the form which Mr. Livesey had constructed, by admitting the air higher up. One of the disadvantages of this shape (which the Liegel furnace, as originally designed, also possessed) was that the combustion of the carbonic oxide took place immediately under the center retort, and developed there a very great heat, which acted rapidly on the retort above it, and on the surrounding brickwork, and was destructive in its action. He believed it would be advisable to introduce the air above the arch between the center and the side retorts; but there was one disadvantage in so carrying the air channels up—viz., the possibility of an explosion in first starting the furnace. Mr. Valon said he took precautions to obviate this; but if the furnace were completely open at the top when heated fuel was put in at starting, there was no fear of explosion, because the gases as they ascended ignited immediately. Mr. Valon did not use steam at the slit at the bottom, and he (Mr. Stevenson) had always contended that these furnaces could be used without steam, as was generally the case on the Continent. The cast iron piece at the bottom was, no doubt, a preservative; but it was not necessary if the furnace was so constructed that the melted clinker, as it ran out

at the bottom, covered the brickwork, and protected it from the action of the fire. It appeared that Mr. Valon found some difficulty in adjusting the air supply; but he was evidently not aware of one secret, which he (Mr. Stevenson) would now disclose. When the secondary supply of air was in proper proportion to the primary supply, the furnace inside was neither perfectly clear nor filled with flame, but was in a state of mistiness; and if, in the regenerative furnace, there was a sight-hole in front, by which anyone could look into it, it could be immediately detected whether it was in a proper condition or not within certain limits. The valves or openings for the air supply must be regulated until the furnace presented the misty appearance by which the back wall and the brickwork were seen to shiver a little. The stoppage of the flues was a difficulty which all had to contend with who tried the regenerative furnace. At Maidstone, where the Liegel furnace was erected, considerable difficulty was experienced with it; and had he been aware of it at the time he should have designed the flues of much larger area, and made them more accessible. His opinion was that the stuff which stopped the flues was a combination of fine ash with a deposit of carbon from the imperfect combustion of the gas; but the white appearance inside the furnace was not peculiar to the regenerative system. When he pulled out an ordinary retort setting in the spring of the present year, the interior was perfectly white; the reason being that the heat had been intense, and the firing had been pretty much in accordance with the generator theory. The furnaces were deep, air being admitted at the top of the furnace door, which burned all the carbonic oxide arising. This whiteness was not in the form of dust, but was a sort of glaze on the surface of the brick. With regard to having fire-brick channels instead of iron pipes, he agreed with Mr. Valon. When he designed the setting of which he showed an illustration last year, all the air flues, as well as those for the waste gases, were designed with tongued and grooved joints, and he believed with such joints, or rabbeted joints, brick flues would be practically air tight. In conclusion, he might say that he had no intention whatever to depreciate Mr. Valon's work in connection with regenerative firing, but he did rather deprecate the adoption of a half-way system, which was really neither one thing nor the other. He should like to see regenerative firing carried out on its theoretical principles thoroughly and practically, and the results put before the Institute, in which case he was sure it would be demonstrated that the expense of constructing a regenerative furnace was not excessive when compared with the results obtained.

Mr. J. Frith (Runcorn) said he had for the last ten months had the pleasure of working a similar furnace to that shown by Mr. Valon in diagrams No. 2—two furnaces to one bed of seven retorts—and he could bear out the statements made as to the effectiveness of this furnace. Remarks were made at the last meeting that they had not sufficient practical information for the theory which was then given as to the cost of the retorts and furnaces, and the working of them. They would all agree with the remarks of the President that they ought to have theory, because this led to practice; but they ought to have a little practice as well. His own impression was that the permanent work of the lower arch (if they had a continuous arch not stopped up) would not cost more than £35 over that of an ordinary furnace. He agreed that it was not necessary to have iron pipes for the air flues, and in the furnaces he was about to construct he was dispensing altogether with iron flues. In letting down the beds, he found the back portion of the iron, just at the top of the drawing, was burnt completely away. First the nostrils were burnt off like icicles, and unless they were kept constantly pricked they stopped up. He believed if the air was carried in as in diagrams No. 2, it would be found that the carbonic oxide was not lighted soon enough to properly heat the middle retort. He must confess that at the commencement he had a great deal of trouble with the working; but after about a month's trial he learnt the secret of it, and from that time to the present he had been much pleased with it. The fuel account had perhaps not been so low as he had anticipated, but they were rather too much inclined to consider the percentage of coke used without considering the quality. In some works he knew that a very small amount of coke was used, but then it was of very high quality; whereas in works where much cannel was used the coke was inferior, and therefore much more had to be employed. In his own works they used a considerable quantity of cannel, making 20-candle gas, and consequently the coke was inferior, and they used as much as 50 per cent. for fuel. He found his regenerative furnace only consumed about one-half this quantity, and consequently he was a gainer to that extent. He found from the returns of coke sold during the last year that it paid for the regenerative furnace. He had applied this system to iron retorts, and had just erected three beds of five retorts 9 feet long and 22 inches in diameter, for calcining bones. He had hoped to have them at work, but had been delayed for some castings, and therefore could not state the result. With regard to the wear and tear, he had just seen the inside of the furnace since it was let down, and from the arch underneath he had a very good view of the whole inside. For about 18 inches upwards it was burnt away, after ten months' work, about one inch. The top portion of it, where the iron box was situate, was burnt half away; in the other half the bricks were almost as clean as on the day when they were put in. He believed that when furnaces were built with brick instead of iron the wear and tear would be very trifling indeed, and that they would work for twice ten months before needing repair. The arch underneath the middle retort was merely burnt away at the edge; but some portion of it was as good now as it was ten months ago. Altogether he was very much pleased with the working of the regenerative furnace. The price of gas had now to be reduced in order to compete with other lights, and managers were obliged to take advantage of every improvement brought forward; and he believed this system of heating retorts was one of the greatest improvements of the day.

Mr. C. Gandon (Sydenham) said that not having had any practical experience with regenerative furnaces, he should not have ventured to occupy the time of the meeting if Mr. Stevenson had not made a reference to the happy state of affairs in which he was, of using only 9 per cent. of fuel; and on this point he would give a little explanation. The coke produced was arrived at by assuming a certain amount to be made per ton of coal, as Mr. Valon had done in his paper. They estimated that 12 sacks of coke were produced per ton of coal used. He spoke of sacks, because there was some little confusion now, in consequence of the new act, as to what a bushel was. If a ton of coal were taken, such as they were now using, and the coke measured as drawn from the retorts, it would be found to produce between 14 and 15 sacks. If sold or used at once, 14 or 15 sacks would be accounted for; but if stored for six months or more, as was sometimes the case, probably not more than 12 sacks would be accounted for; and therefore they estimated it at 12 sacks. The sack referred to was four striked bushels, or three heaped bushels, and the weight about 1 cwt., and he was referring to north country coals, such as were used in or about London. As they only estimated 12 sacks per ton, naturally if 14 sacks were produced and sold they obtained 2 sacks more than were estimated for, which made the fuel account appear better than it actually was; and he believed that Mr. Valon had done the same. From the figures first given he appeared to use only 14 per cent. of fuel; but this was an estimate, and further on in his paper he told them fairly that he found it to be 18 per cent. by measurement, on the assumption that 13 cwt. of coke was produced per ton of coal. It would be interesting if they could obtain the actual weight produced and the actual weight used. According to his accounts only 9 per cent. was used for fuel; but he must admit that it was a misleading statement, and he hoped it would not be considered as an argument against regenerative furnaces, for he was not sure whether by using them he would not be able to sell a little more coke than they produced. The principles of generator furnaces appeared to be clearly understood, but he was not quite sure that what was meant by regeneration was as clearly defined. Mr. Valon said he did not attach much importance to regeneration or recuperation; but it appeared to him (Mr. Gandon) that if it were properly worked out a great economy in fuel should be obtained from the regenerative principle, by which he understood the utilization of the waste heat after it left the retort benches, and this did not appear to be carried out in the system of heating the air which he had described. The air was heated from the sides of the furnace and flues, and therefore the heat which was taken up by the air was absorbed before it performed its legitimate work in heating the retorts. If it could be first used to heat the retorts, and then what remained of it used to heat the air required for combustion, it appeared to him certain that far better results would be obtained. In fact, it was generally understood that more than 50 per cent. of the heat generated in an ordinary furnace escaped unutilized up the chimney, and it appeared to him that it was in this direction that great economy was to be sought for.

Mr. W. Foulis (Glasgow) agreed that this system could scarcely be called a regenerative system. The air was heated, it was true, and a certain amount of air was admitted to consume the carbonic oxide in the generator, but it was not regenerated. The waste gas from a retort setting must leave that setting at the temperature of the retorts, and the principle of regeneration was to endeavor as far as possible to get that heat back again into the furnace. He rose, however, not to criticise the paper, but rather for the purpose of stating the experience he had had with regard to regenerator furnaces. About 18 months ago he entered into communication with Dr. Siemens, and the result was that they had erected four furnaces of eight retorts each on Dr. Siemens plan, carrying out his principle in its entirety. The arches were 8 ft. 6 in., and there were eight single retorts 18 in. by 13 in. by 9 ft., set back to back. Each setting had its own producer. Of course, as in all new things, there was a great deal of difficulty at first; but after working for some time, and often being disheartened, they had now got it into successful operation with very good results. The fuel they used was entirely made from Scotch cannel, and was very inferior; but notwithstanding this they were able to produce almost any heat they wanted. Their fuel account, although not a matter of very great interest to them—as the coke was so inferior that it was difficult to sell—had been reduced by two-fifths, and the amount of coal carbonized had been increased from 14 cwt. per retort in 24 hours to 17 and 18 cwt. They had worked off as much as one ton, and he

hoped by and by to be able to manipulate a ton of coal every 24 hours. They made 9,800 or 10,000 cubic feet per ton, which was a large make considering the quality of coal used. One great advantage was the increased durability of the retorts from the regularity of the heats, and the absence of dirt on the outside of the retorts. The heats were steady from one week to the other, and were easily kept up. The retorts and the whole setting remained perfectly clean. Dr. Siemens had been kind enough to prepare two illustrations of the arrangement adopted, which were on the wall. The producer was a cylinder of brickwork 3 ft. in diameter and 6 ft. 6 in. high, encased in sheet iron. There were not any fire-bars, the coke resting upon the brickwork at the bottom of the cylinder or pit. Round the bottom of the cylinder there were a few holes about 6 in. high and about 1 ft. long, just sufficient to get the clinker out. The gas was carried from the producer through a flue, and entered the retort setting underneath the side retorts, where it met the air coming from the regenerator. It entered the setting not by a number of small openings, but by one large opening on each side, and met the air entering also by a large opening, the effect of which was to avoid the localization of intense heat. The flame was carried in a body over the whole setting, and the retorts were equally heated from end to end and from top to bottom. The generator consisted simply of a series of zigzag flues. The waste gases were carried down through the flues on each side of the air passage; and the air entering first into a large chamber in the center, passed through the flue in the center of the regenerator, and by the time it entered the setting it was nearly red hot. The producers were very easily worked, being only filled once in six hours. The cover of the producer was lifted just before the necessary number of retorts were drawn into the producer; the cover was then put on, and the remainder of the retorts were drawn, and nothing more was done for the next six hours. The men went down perhaps once in three hours to remove the ash. Altogether it was very successful, and they were going to extend the system. Some remarks had been made about the question of steam. They found that steam was a great advantage. Not only did it yield better gas, giving hydrogen instead of large volumes of nitrogen, but there was also this advantage: The coke used contained sometimes as much as 15 or 20 per cent. of ash, and at first they had much trouble with clinker; but by using steam this was brought down in the form of fine ash, and gave no trouble at all. The ash was removed from below, and the men had scarcely ever to touch the clinker or ash from above. So far as his experience went, he was quite certain that great advantage would be reaped by the introduction of this system of firing.

Mr. F. D. Marshall (Copenhagen) said the fuel account given by Mr. Valon was remarkably low, and the following figures, from some large German works where the Liegel, Goldbeck, and Didier regenerative furnaces were employed, might be useful. In comparing the figures it was necessary to take works of somewhat similar size; and some of those named were using the regenerative system, and others the ordinary ovens. The results were obtained from the half yearly accounts of the companies from January, 1879, to January, 1881:

| | Coal Used. Kilogrammes. | Percentage of Coke Used. Kilogrammes. | Description of Furnace. |
|---|---|---|---|
| Brandenburg | 2,267,417 | 35.57 | Ordinary ovens. |
| Bromberg | 3.312,200 | 34.38 | Liegel regenerative. |
| Tilsit | 964,750 | 42.00 | Ordinary ovens. |
| Lodz-in-Polen | 3,840,885 | 46.00 | Liegel regenerative. |
| Stettin | 1,350,000 | 32.60 | Liegel, Goldbeck, and Didier regenerative. |
| Stralsund | 2,273,956 | 24.50 | Liegel. |
| Konigsberg | 16,496,200 | 28.51 | Ordinary ovens. |

There could, he said, be no doubt considerable progress had been made in the construction of the ovens during the past twelve months, and probably a further saving of fuel had been effected; but several German works were now going back to the old system of firing, partly on account of the non-saving of fuel, and partly because of the excessive wear and tear resulting from the adoption of the regenerative system.

A member asked what kind of coal was used.

Mr. Marshall said he could give the description of coal at Bromberg—it was Dean's Primrose; at some of the other works Wallsend. It was all English coal except at one place, where German coal was used.

Mr. A. Edwards (Taunton) thought that the whole of this question must turn on the economical result of the regenerative furnace; and, as bearing on this point, he should like to ask if Mr. Valon could say what was the total cost of the settings he had erected, including the house, so that those who were already using old-fashioned houses might know what extra cost would be incurred by adapting them to regenerative firing; also what extra sum in money would be received for coke after adopting the regenerative system. His own experience was that he might produce 6, 7, or 9 cwt. of coke per ton of coal, but he did not receive so much money from the 9 cwt. as he did from the 6; so that practically he should be saddling himself with 3 cwt. more coke to dispose of without getting anything more for it.

Mr. C. Hunt (Birmingham) said he rose in response to the inquiry made by Mr. Carr. It was known that at Birmingham they were going somewhat largely into the regenerative system, and he might say that his own estimate of the cost of applying the furnace which they had decided partially to adopt was from £3 to £4 per mouthpiece beyond the ordinary setting. He felt it to be a little ungenerous to say anything in disparagement of so eminently practical a paper as was Mr. Valon's; but he must admit that he concurred very largely in what Mr. Stevenson had said with regard to it—that, in not applying regeneration, it was stopping half way, and that Mr. Valon did not appear to get a complete gasification of the coal. Regeneration was of importance, as Mr. Foulis had pointed out, to recover the heat which would otherwise be lost; and not only that, but to get a larger amount of work out of the retorts. Mr. Marshall had made a statement which had come upon them rather by surprise, that many of the German engineers were now returning to the ordinary system of firing. He could only say that he had lately met a prominent German engineer, Herr Oechelhauser, the engineer of the German Continental Gas Company, and he had expressed his entire faith in the system they had adopted, both with regard to the saving of fuel, and also the wear and tear of retorts.

Mr. G. E. Stevenson said the results which Mr. Marshall had given must not be compared with English works, because in Germany they employed such tremendous heats that they always used a high percentage of fuel. He would give the results at a few places where ordinary furnaces were in use. At one, 80 per cent. of coke was consumed, or 55 lbs. per 100 lbs. of coal. At Kolberg it was 66 per cent.; at another place, 62 per cent.; at another 75 per cent.; at another 85 per cent.; and at another 62 per cent. Therefore the 34 per cent. Mr. Marshall had mentioned should be compared with the 60 or 80 per cent.

Mr. Marshall said they must also look at the coal used. The percentage of coke used was in comparison with the size of the works. The places mentioned by Mr. Stevensen were all small works. If they took works of approximate size it would be found that there was very little difference in the coke.

Mr. J. A. Head said, as the representative of Dr. C. W. Siemens, some inquiries had been made of him as to the cost of the regenerative furnace. He should therefore like an opportunity of stating that at the Paris Gas Works, where this furnace was adopted in earlier days, in a more complicated form than was now recommended by Dr. Siemens, the cost of application was found to be greater by £160 than an ordinary setting, but the saving realized was about £120 per annum; so that in about 16 months the whole expense was recouped. After that period the entire saving went to the credit of the regenerative furnace, and amounted in the aggregate to £7 per retort per annum, being (for 3,000 retorts which were at work in 1878) rather more than £21,000. If they took the number of retorts which were in use in this country, and multiplied it by 7, and the product by 20 years, it would be a measure of the loss this country had suffered in consequence of not using regenerative furnaces.

Mr. Valon, in reply, said the cost of the furnace was from about 43s. to 45s. per mouthpiece. He quite agreed with Mr. Carr that rather than have no regeneration at all he would have outside generators, which could be just as easily used, only they would have the disadvantage of being placed outside instead of inside the setting. Mr. Stevenson asked how he reckoned the quantity of coke made. He had gone on the old standard, to prevent confusion, taking 36 heaped bushels as the quantity made per ton, and estimated that each 36 would weigh 13 cwt. He did not know any practical mode by which the actual quantity could be deduced; but in his paper he had given the exact quantity by measure and weight, and that actually used. He had also said that they never had such a good result in the half year's working as the trials showed. By the actual measure it was 18 per cent. of the weight, which was 13.16 lbs. per hundredweight of coal carbonized. The heat, as nearly as he could estimate, ranged about 2200° F. Mr. Stevenson said his fuel account was excessively low, and that it was almost impossible with generation to get so low a return for fuel, unless regeneration were employed. Further on he went on to say that there were other works in the country in which the same result was being obtained with an equal quantity of fuel. He could only say that the figures were given exactly as taken from the books, and every figure so far as he knew, was perfectly correct. He was glad to find that Mr. Frith's experience was something like his own. In answer to Mr. Foulis and several other gentlemen, he thought himself that it was desirable to use as much waste heat as possible, but it was only a question of cost in construction. If they thought they could get a better result by using waste gases, by all means do so. He quite admitted that he had only gone half way, because he looked upon it as a matter of practical economy, and was doing nearly as well as by going the whole way. If he were convinced that by going the whole way it would be better, he should do so. His paper only referred to the system of generator firing, not regenerator firing, and the one must not be confused with the other. If those gentlemen who were using regenerator firing would give their figures as plainly as he

had given his, it would be possible to compare results. Mr. Marshall's statement had taken him somewhat by surprise; although perhaps if they went into the question more minutely the difference might be accounted for in the quality of the gas or coke produced. The coke they made was extremely hard, almost like locomotive coke. There was no mixture; it was made from clean Newcastle coal, which produced the very best coke. With regard to the total cost of the retort house, he had not the figures with him, but he should be pleased to forward them to Mr. Edwards, or anyone else who applied for them.

The President said they were greatly indebted to Mr. Valon for so plainly bringing forward the results of his experience at Ramsgate during the last six months. If they had more papers of the same kind they would all be better instructed than they were at present. As Mr. Valon had justly said, it was not a paper on regenerative furnaces; he had gone half way, and obtained his heat by a comparatively new method. It was quite true that 6,000 feet of gas per mouthpiece was not an extraordinary yield, and there were plenty of managers who were getting this yield, or thereabouts, with ordinary settings. They would be very glad to have results from gentlemen using regenerative furnaces, and he hoped Mr. Foulis would be good enough to give them the benefit of his experience at a future time.

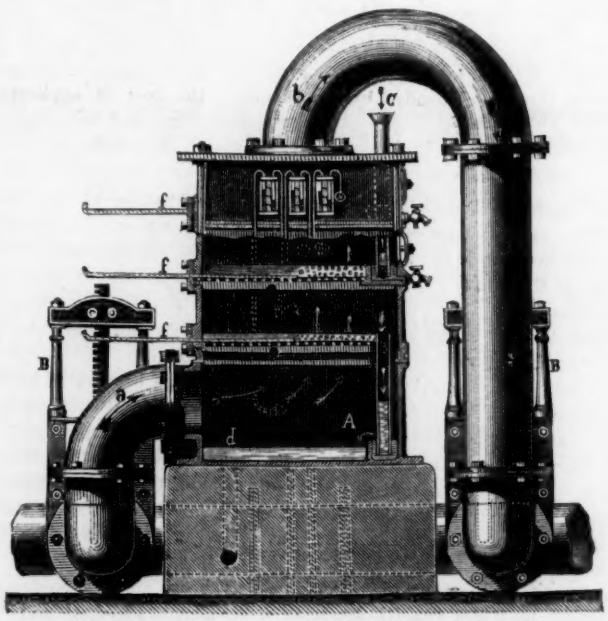
[Translated for the AMERICAN GAS LIGHT JOURNAL from the "Journal des Usines a Gaz."]

## Chevalet's System, Washer-Condenser.

By. M. CHEVALET.

A paper read before the French Society of Gas Engineers Paris, France, June 20, 1882.

At the meeting of our Society, held at Nantes, last year, I had the honor to exhibit a washer made in horizontal sections, the outer covering of which was made of glass. By this means you saw illuminating gas wash itself in water and purify itself completely of the solid matter that always accompanies it. To-day I propose to show you no longer an experimental apparatus, but a practical one, which may be used in all gas works for removing tar and ammonia from illuminating gas.




I have called my apparatus a washer-condenser, because it performs two functions at the same time. It washes the gas and condenses it, or, rather, it holds the tar and soot, just as the apparatus of MM. Pelouze & Audouin and M. Servier do, which are improperly called condensers. My washer-condenser is usually made of three plates of sheet iron perforated with holes from 2 to 3 millimeters (.03937 inch) in diameter, placed horizontally one above the other in rectangular cast iron compartments. Each plate is movable, and slides in a bearing which runs along the outside of the compartmant; each compartment has an overflow pipe, f f, which dips into a basin, g. These overflows, as well as the basins, are independent of the perforated plates. The result is, these plates being movable they can be withdrawn at will from the washer by means of a lateral opening which runs along the level of each compartment. Over each perforated plate slides a non-perforated plate, b, mounted with rubber, d, which supports a metallic plate, m. This non-perforated plate, b, is intended to uncover a greater or less number of the holes of the perforated plate, according as the process demands; that is to say, according to the quantity of gas which passes into the washer. To regulate this, all that is necessay is to draw out or push in the non-perforated plate b.

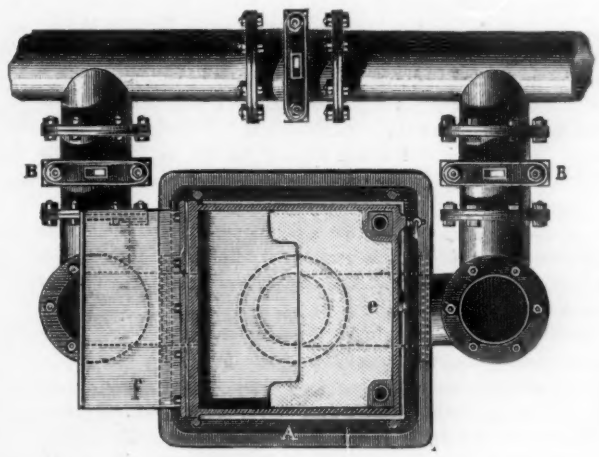
A small stream of ordinary water trickles through a funnel, h, on the first upper plate; this water diffuses itself over the bottom of the section, as the gas comes up from below, sustained as it is by the gaseous current; when it reaches the level of the overflow, f, it flows into this pipe, fills the basin immediately below, covers the second section as it did the first, afterwards passes into the overflow of this section to again diffuse itself over the third lower section, then empties by means of the overflow of the third section, falls on the bottom of the washer, and finally leaves it by means of a syphon discharging into the cistern for ammoniacal water.

In front of each section is placed a graduated manometer (gauge), which shows the amount of gas above and below each section. This manometer is intended to show the pressure upon each section. If it appears that there is not a sufficient pressure, it is because there are too many perforations uncovered for the volume of gas which passes. The non-perforated plate is then pushed in until the manometer shows a pressure of 10 to 12 millimeters. If, on the contrary, the manometer shows too great a pressure, it is because perforations enough are not exposed; the non-perforated plate is then drawn out to uncover a greater number. This operation is repeated for all the sections. There is a cock or plug, e, just below each overflow basin, for the purpose of cleaning out tar or the other impurities which may collect in the basins and prevent the overflows from working.

The wash water which flows from this washer is more or less charged with ammonia and tar. This depends upon the position in which the washer is placed and the quantity of water that passes through it. Usually this washer is placed next to the ordinary coolers and before the purifiers.

If the works already use scrubbers it is altogether useless to sprinkle with ammoniacal water. I advise even the removal of the coke or other substances generally employed, in order that the tar accompanying the gas may not make these other substances sticky, since my washer is intended to draw off all the tar. The scrubbers would thus act as coolers and as dust chambers, which is not a bad thing, since the utility of great cooling pipes in gas works is generally recognized; these great pipes act as reservoirs or expansion chambers.

My washer-condenser can be placed before the scrubbers; and this is perhaps its best position to remove all the ammonia with the least water possible. This is how it may be done: The scrubbers being filled with thoroughly baked and porous coke, broken and carefully sifted to remove all dust, are sprinkled with a stream of pure water at the ratio of 50 liters for each 1,000 cubic meters of gas manufactured. This water, which only gives




humidity to the coke, considering its small quantity, passes afterwards directly into my washer-condenser, where it absorbs three-fourths of the ammonia from the gas, and at the same time deposits the tar; after this it enters the ammoniacal reservoir.

The advantage of so doing is that no pump is required to raise the wash waters; as a consequence no machine is needed, nor any hand power; it will certainly permit the removal of all the ammonia which escapes from my washer. The experiments which follow this course demonstrate that this result ought to be obtained. This arrangement requires that my washer be placed a little below the scrubbers, which is not difficult, considering its height.

Whatever be the variations that are adopted in setting, I am able to affirm that the water which is introduced in my washer passes through it only once. The flow can be so regulated that from 45 to 50 liters for every thousand cubic meters of gas manufactured passes through it.

It is well that the wash water be the purest and coldest possible; in fact, at the Saint Quentin gas works, where the washer has been installed for the

first time, thanks to the initiative of M. Frére, its director, the following facts have been obtained:

1. The colder the water is the less ammonia the gas contains on leaving the washer; thus in winter it was manufactured with 0.5 gr. of this product ($AzH^3$) per cubic meter, and in warm weather there was one grain. (To find the amount of sulphate—multiply the quantity of ammonia by 4.)

2. The water ought to be pure; when highly calcareous, as are the waters at St. Quentin, the first upper plate encrusts after the manner of a steam boiler; when this encrustation occurs it becomes necesssary, from time to time, to add to the water which passes through the washer a little water mixed with muriatic acid to dissolve the crust, which is only carbonate of lime; or, what is still better, uncover a greater number of perforations by drawing out the non-perforated plate. The encrustation of the upper plate is very curious, and astonishing, at first sight. It is explained in this way. The waters of St. Quentin hold in solution a great quantity of bicarbonate of lime; the coal gas in passing through this water decomposes the carbonic acid of the water, then the scale is deposited in the form of an insoluble carbonate of lime. This is the same effect that is produced by petrifactive springs; but in this case experienced with ordinary water.

If distilled water be used to supply the washer, the trouble from encrustation will not be encountered.

For that matter distilled water could be very easily employed, considering how small a quantity of it is necessary to wash the gas. It would be sufficient to condense the steam of the apparatus which operates the exhausters. Indeed, this would give even more than is requisite.

3. The two lower plates are never encrusted, nor obstructed by tar; they always allow free passage to the gas.

I would pause a moment here to dilate upon this point, for last year it was objected that these perforated sheets would become choked up like the perforated sheets in Pelouze and Audouin's system of condensation, or like the grating in Servier's system. The sheets of metal in my washer do not choke up with tar, for this reason. When you examine unpurified gas wash itself in my apparatus, you perceive that the tar does not attach itself to anything afterwards, it mingles with the water under the form of a multitude of small drops which glide along with the wash water through the overflows. On the contrary, in vessels which are operated without water, like those mentioned above, the tar adheres to the sides, it moves slowly over these sides, because of its adhesive nature, and when a low temperature is reached its flow, so to speak, is arrested. Besides, I find that coal gas not only holds tar in suspension but also contains solid particles. I have proved beyond all doubt, in experiments made at several gas works, that only tar was first deposited, and that the dust or soot was carried much further along, and even into the purifiers. When you interpose a dry filter, like the filter of M. Servier, or the perforated plate of MM. Pelouze and Audouin, over a gaseous current, the tar is precipitated in case there is a sufficient pressure; but the soot that the gas contains sticks to the tar and forms a sort of mastic in a very short while. It is this which seemed to me to explain the frequent clogging of these vessels when operating on gases made from certain coals which give off large quantities of tar in distillation.

You can easily prove that the tar which comes from these vessels contains soot, by dissolving this tar in benzine, and afterwards filtering the solution through some filtering paper. The soot will remain on the filter, and can be weighed to determine its quantity.

In experiments made on chimney gases I have had bars, 10 millimeters apart, completely clogged, and that in a few days.

The soot which exists in gas is very difficult to precipitate completely, as I have proven at the works at St. Quentin, where gas that had passed through my washer, with perforations three millimeters in diameter, still gave off soot on being passed through the washer a second time with the perforations reduced to one millimeter in diameter. This soot, not tarry at first sight, has given me, in alcohol, soluble products having a tarry appearance.

My washer may be also made a condenser only, if it is thought, for example that it requires too great a pressure, as would be the case in works which are without exhausters; in this event only one perforated plate is necessary. Under these conditions, with a single plate, with a required pressure of only 10 to 12 millimeters, the tar is precipitated as effectually as with the best mechanical condenser requiring a pressure of 60 to 70 millimeters. From what has been said above, in order that the plate may work, and not become clogged, it is essential that it should always be covered with water.

The advantage of my system of washer is to permit the use of as much space for active work as is desired. All that is necessary to do is to stop the flow of gas for an instant, to dismount the plate, m, which covers the slit, or move the sliding plate, to unscrew a stopper, o, which is found opposite, and push the perforated plate out of the washer, replace it with another, and refasten the plate, m. This takes from 10 to 15 minutes. One could even make the perforated plates longer and work them from without, as is done with the non-perforated plate, b. In experimenting with gas already passed through this washer, with the perforations three millimeters in diameter, and repassing the same gas through another similarly constructed apparatus, differing only in having the perforations much smaller than one millimeter, I had remaining but 0.069 gr. ammonia per cubic meter of gas.

With gas washed at the scrubber, and containing still 1.580 gr. $AzH^3$ per cubic meter, there remained, after passing through the same washer, only 0.300 gr. I ought to say here that the perforated plates which have given me these results require a certain pressure; thus the No. 2, perforations one millimeter diameter, with a stream of water of 10 millimeters, requires 40 millimeters of pressure per plate; in dry operations, *i.e.*, without water on the plates, each plate requires 30 millimeters pressure. In practice, then, it is not well to use plates perforated too closely; the better way is to finish the washing, as previously stated, by a column of coke or small pebbles, simply moistened with a little pure water, this dampened column (as M. Frere and myself have agreed) absorbs the rest of the ammonia contained in the gas. It replaces advantageously the wet sawdust which some works use in their purifiers to arrest the ammonia which has escaped from their scrubbers.

When damp sawdust is used in the purifiers the ammonia is almost entirely absorbed by the dampness of the purifying material, as the following analyses prove. At the works at Troyes a sample of gas which contained 1.79 gr. on entering the purifiers left them with 0.133 gr. At the gas works at St. Quentin the gas contained 0.290 gr.

The ammonia thus absorbed by the purifying substances is certainly lost, because it evaporates when these substances are revivified in the air; it is this which causes unpleasant odors in the neighborhood of gas works. You see, then, from these experiments, that it is of importance to retain all the ammonia of the gas before it enters the purifiers, and the best method to do this is to employ pure water in a rational manner; in so doing you will collect from three to four kilogrammes of sulphate of ammonia, or more, per ton of distilled coal.

## Meeting of the Societie Technique de L'Industrie du Gaz en France.

The Annual Meeting of the Society of French Gas Engineers was held in Paris, France, on the 19th, 20th and 21st of June. M. Charles Foucart presided. There was quite a large attendance of members, and several papers were read; although, as a whole, it cannot be said that much which is new or important has been added to the literature of the gas industry. But one prize was awarded, and that was bestowed upon M. Melon, for his paper on "Retort Furnaces," etc. We give below the

### President's Address.

Gentlemen and dear Colleagues: I am indebted to the kindness of your committee for the honor of being called upon to preside at two of your meetings; the first was in the month of October last, on the occasion of the Exposition of Electricity; the second is to-day, the opening of your regular annual meeting.

Permit me here to call your attention to some facts of interest to our industry that have occurred since our last convention.

Last July our esteemed first president was made a Chevalier of the Legion of Honor as much for services rendered in civil life as in the advancement of our industry. This is but the just recompense of an honorable and industrious life; we all rejoice to know that he has received so well merited a distinction. I believe that I express the sentiments of the Technical Society in sending him the congratulations of all; at the same time we regret to learn that the condition of his health is such as no longer permitting him to take part in our labors.

Another of our members, M. Bremond, has been made a corresponding member of the Royal Spanish Academy of the Exact, Physical and Natural Sciences, for his interesting studies on the pressure and illuminating power of gas.

M. Bremond attributes the distinction he has received to the Technical Society and the favors it has bestowed upon him; but we believe that his own merit and his own works have exercised a greater influence in procuring this title for him, and we applaud the decision of the Royal Spanish Academy.

During the present year we have lost three of our members by death. M. John Burnett Stears, one of the oldest members of the profession is no more. In 1837 he competed with others for the erection of works in London, and carried off the prize. Some years after he constructed the works at Versailles, Brest, Rennes, Saumur, Vierzon, etc., in France; Parma, Plaisance and Alexandria in Italy. He was the owner of the works at Livourne, Laval, Alençon, Avranches and Argentau, and principal stockholder and director of the works at Cherbourg.

Those of our members who knew him have appreciated his affable and generous character.

M. Veruhes, director of the gas works at Ajaccio has also been removed by death from amongst his family and friends.

Finally, M. Tindall, representative of the house of Kœrting Bros., whom we have several times heard with interest at our meetings during the debates on steam exhausters, is also dead.

We have received the resignations of five of our members—MM. Dozell, Chasle, Ploquin, Armand Brotot, and Dejaifve, who are no longer engaged in the manufacture of gas. While regretting to have to sever our connection with them, we are obliged to conform to their determination.

Seven other members of our Society, in arrears for the payment of several years dues, and not having responded to the reiterated demands of your treasurer, have been stricken from the roll of members. They owed in all 24 assessments, about 480 francs.

The number of our associates and members, which was 366, would thus be reduced to 351; but by reason of 74 new admissions we now number 425—composed as follows:

Honorary members, 14; active members, 354; associate members, 57; total, 425.

The gas companies of France, realizing more and more the services that our Society is able to render the manufacturers of gas, have continued to aid us in our efforts. I cannot too strongly press upon the attention of the large companies, so much interested in our progress, the duty of participating in the expenses of our Society, which would not be able, from the dues of its members alone, to meet all the expenses that the prizes which it offers to competitors necessarily entail.

This year the subsidies received from the different companies amount to 18,575 francs. The sums that we have received this year by way of subsidy, compared with those of last year, show an increase of 2,425 francs.

Since the month of October last, the use of the electric light has not been advanced in Paris, and gas has indeed even retaken possession of the Avenue de l'Opera; and this has been accomplished despite the assurances of electricians that their light was the best of lights, and, at the same, the most agreeable and economical, and have often-times coolly informed us that gas has had its day.

In London, notwithstanding an Exposition of Electricity still more recent than our own, the same state of affairs appears to obtain. It seems, from the report of M. Haywood, inspecting engineer of the city, that the lighting of three districts, where attempts at illuminating by electricity have been made, cost 110,000 francs, while with gas it would have cost only 50,000; even then no account being taken of interruptions of the electric current and of extinctions.

Nevertheless we must not believe, gentlemen, that electricity will not make further progress. It is our duty to endeavor to find economical means for the use of gas; our associate, M. Servier, promises us, sometime during the session, a communication which ought, he thinks, lead to a revolution in our industry.

With the hope that some one of our members will be able to give us some useful information concerning electricity, its net cost, and its applicability to purposes of illumination, as well as a motive power, we have designated during the last order of business, a time for discussing this interesting question which will lead us also to consider the not less interesting one of the photometric standard. In reality, the usage of great luminous centers, whether they be supplied by electricity or by concentrated gas burners, renders a true estimate of the illuminating power more difficult; it will be necessary to find an apparatus which gives more accurate information than those in present use.

Our associate, M. Giroud, has treated this subject in a paper originally intended for our convention; but owing to the labors of M. Vernon Harcourt, in England, and those of M. Crova, professor of the faculty of sciences at Montpellier, he was obliged to publish it before our meeting; we hope that he will be good enough to show us his apparatus, and to allow discussion to be had on this subject.

At our two past meetings M. Leclerc has entertained us about pension funds, and your committee has appointed a commission to inquire into his project. You will hear the report of M. Leclerc on the labors of the commission, and on the steps that it will be necessary to take, and here again we shall be happy if the discussion leads us to make another advance towards the accomplishment of this philanthropic measure.

For the last few months, gentlemen, our business has been disturbed by threats of competition on the part of manufacturers, jealous, beyond all doubt, of the prosperity of gas manufacturers—a prosperity often acquired by long and painful sacrifices—which they wish to turn to their own account. With this end in view they have asked permission from the prefects to place conduits on the roads dependent upon the grand highways, and traversing the principal cities of France. Certain prefects, not taking into account the contracts made by the authorities who had already granted the exclusive privilege of lighting their cities, have conceded these permits.

Several of our members have written the Society to know what it would do under similar circumstances; but, you know, we are engineers, and the aim of our Association is especially and exclusively technical. However, your committee did not wish to remain indifferent to this question, and has addressed a protest, embodying a distinct declaration of the rights of the grantees in the different cities, which your president has sent to the proper authorities. We have no doubt but that this protest will be heard and justice rendered us.

The papers received this year are not as numerous as in preceding years. We account for this diminution by the fact that our members have been engaged in dealing with threatened competition. We have every reason to believe, and we hope, like causes will not obtain in the future. We make an appeal, then, to all, and especially to our young engineers, to bring before us their numerous and interesting studies and discoveries. I would add that next year our meeting ought to be held in the south, probably at Marseilles; it will possibly be advantageous to announce the date of meeting some while in advance, so that those who intend to present papers may have ample time to collect and arrange the results of their researches.

We have also to regret that we are not able to offer you this year an excursion to any point of interest. The Paris company who so cordially received us at Ivry in 1878, and at their works at Clichy two years ago, have no new establishment in this vicinity, and we felt a delicacy in asking them to permit us to see again those works that we had already visited. In two years more their works at Landy will be sufficiently advanced to enable us to pay them an instructive visit, and we hope they will not refuse us permission to study them as closely as we have those already mentioned.

Before concluding, gentlemen, let me call your attention to a matter of much interest to the French gas manufacturer. You know that illuminating by gas was perfected by one of our countrymen, Philip Lebon, chief engineer of bridges and roads, born in 1767, at Brachay, Haute-Marne. While occupied in perfecting the steam engine his researches incidentally led him to the thermo-lamp. The first of Philip Lebon's patents bore date, the 25th Fructidor, year IV. (September 11, 1796.)

Returning to Paris, Lebon communicated his ideas to Fourcroy, who induced him to persevere in his studies; he set up his apparatus in his own house, Rue de l'Ile St. Louis. In the year VII. he read a paper before the Institute relative to his invention, which he had patented on the 6th Vendemair, year VIII. (September 28, 1799.)

The city of Chaumont, the most important place in the Department in which Philip Lebon was born, desires to perpetuate the memory of this useful citizen by erecting a statue in his honor.

But the city is not rich, its resources do not permit it to go to any considerable expense. It offers to give the necessary land and to prepare a place in front of its city hall, and asks the gas manufacturers to furnish the statue. It has applied to our Society, which accepts with pleasure the privilege of taking part in erecting a monument to the founder of its industry. A committee has been appointed to solicit subscriptions, which will be received by our treasurer. I appeal, then, to all manufacturers of gas and gas works apparatus to take part in this work of professional acknowledgment.

## English Regulations Recommended for the Lessening of Fire Risks of Electric Lighting.

The following rules and regulations for the lessening of fire risks from electric lighting were recommended by the Society of Telegraph Engineers and Electricians. These restrictions and regulations are in accordance with the report of the special committee appointed by the Council to investigate the subject.

These rules and regulations are drawn up not only for the guidance and instruction of those who have electric lighting apparatus installed on their premises, but for the reduction to a minimum of those risks of fire which are inherent to every system of artificial illumination.

The chief dangers of every new application of electricity arise mainly from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing" or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the production of heat. These defects can only be detected by measuring by means of special apparatus, the currents that are, either ordinarily or for the purpose of testing, passed through the circuit. Bare or exposed conductors should always be within visual inspection, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon, such conductors might lead to "short circuiting" or the sudden generation of heat due to a powerful current of electricity in conductors too small to carry it.

It cannot be too strongly urged that amongst the chief enemies to be guarded against are the presence of moisture and the use of "earth" as a part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and

danger. The chief element of safety is the employment of skilled and experienced electricians to supervise the work.

I.—The Dynamo Machine.

1. The dynamo machine should be fixed in a dry place.
2. It should not be exposed to dust or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be perfect.
5. It is better, when practicable, to fix it on an insulating bed.
6. All the conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II.—The Wires.

7. Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left to itself it cannot permit of a permanent arc or of heating, and its stand should be made of slate, stoneware, or some other incombustible substance.

8. There should be in connection with the main circuit a safety fuse constructed of easily fusible metal which would be melted if the current attain any undue magnitude, and would thus cause the circuit to be broken.

9. Every part of the circuit should be so determined that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and changes of circuit, from a larger to a smaller conductor, should be sufficiently protected with suitable safety fuses so that no portion of the conductor should ever be allowed to obtain a temperature exceeding 150°F.

These fuses are the very essence of safety. They should always be enclosed in incombustible cases. Even if wires become perceptibly warmed by the ordinary current, it is a proof that they are too small for the work they have to do, and that they ought to be replaced by larger wires.

10. Under ordinary circumstances complete metallic circuits should be used, and the employment of gas or water pipes as conductors for the purpose of completing the circuit should in no case be allowed.

11. Where bare wire out of doors rests on insulating supports it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.

12. Bare wires passing over the tops of the houses should never be less than seven feet clear of any part of the roof, and they should invariably be high enough, when crossing thoroughfares, to allow fire escapes to pass under them.

12. It is most essential that the joints should be electrically and mechanically perfect. One of the best joints is one whipped around with small wire and the whole mechanically united by solder.

14. The position of wires when underground should be efficiently indicated, and they should be laid down so as to be easily inspected and repaired.

15. All wires used for indoor purposes should be sufficiently insulated.

16. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses like iron girders or pipes, they should be thoroughly protected from abrasion with each other or with metallic masses, by suitable additional covering; and where they are liable to abrasion from any cause, or to the depredations of rats or mice, they should be sufficiently encased in some hard material.

17. Where wires are put out of sight as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated.

The value of frequently testing the wires cannot be too strongly urged. It is an operation, skill in which is easily acquired and applied. The escape of electricity cannot be detected by the sense of smell as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III.—Lamps.

18. Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting.

19. The lanterns and all parts which are to be handled should be insulated from the circuit.

IV.—Danger to Person.

20. To secure persons from danger inside buildings, it is essential so to arrange the conductors and fittings, that no one can be exposed to the shocks of alternating currents exceeding 60 volts; and that there should never be a difference of potential of more than 200 volts between any two points in the same room.

21. If the difference of potential within any house exceeds 200 volts, whether the source of electricity be external or internal, the house should be provided outside with a switch so arranged that the supply can be cut off.

The following is the list of names of the gentlemen who composed the committee:

Professor W. G. Adams, F.R.S., vice-president; Sir Charles T. Bright, ; T. Russell Crampton; R. E. Crompton; W. Crookes, F.R.S.; Warren De la Rue, D.C.L.,F.R.S.; Professor G. C. Foster, F.R.S., Past President; Edward Graves; J. E. H. Gordon; Doctor J. Hopkinson, F.R.S.; Professor D. E. Hughes, F.R.S., vice-president; W. H. Preece, F.R.S, Past President; Alexander Siemens; C. E. Spagnoletti, vice-president; James N. Shoolbred; Augustus Stroh; Sir William Thomson, F.R.S., Past President; Lieut. Colonel C. E. Webber, R.E., President.

## Petroleum in India.

The issues arising, says the *Ironmonger*, out of the detention at Calcutta of a number of cargoes of petroleum are not without interest to the trade in this country, and may seriously affect the same class of business in the Australian Colonies and other warm climates. The cargoes in question are alleged to have been detained because the oil will not pass the tests imposed by the Indian Petroleum Act of 1881. Under that Act no oil is allowed to be imported into India which will burn at a lower temperature than 110°F. by the fire test, or 73°F. by what is known as Abel's flashing test. The parties interested in the cargoes under detention state that the oil was properly shipped at New York, and that it is guaranteed not to flash below 73°. They also contend that Abel's test cannot be applied with reliable results, especially in a climate like that of India.

In support of this allegation they bring forward some remarkable testimony. They show that the same oil tested by the authorities of the German Government, simultaneously at Berlin and Munich, flashed at 70° and 73° respectively. Two portions of the same sample were tested by Dr. Foerster, of the Imperial Standards Office at Berlin, alongside each other, and one flashed at 77°, whilst the other flashed at 80°. Sealed samples of a cargo of oil were sent here from Bombay last year, and when tested one lot flashed at 73° and the rest at 74° to 76° Abel; and the same sample of oil tested by Dr. Lyon, official analyst at Bombay, in November last, flashed first at 72°, and five minutes later, under precisely similar conditions, it flashed at 66°.

If these allegations be accurate—which we have no reason to doubt—it is abundantly plain that the existing state of things cannot possibly continue. If the instruments devised by Prof. Abel do not act reliably in warm climates it is obviously unjust that they should be the means of hampering the course of this important industry.

In the particular instance under notice 200,000 cases of oil have been condemned, notwithstanding that the petroleum had been carefully sampled and tested by the inspectors of the New York Petroleum Exchange prior to shipment. The Indian Government will do well to have the whole subject thoroughly investigated without delay, and our friends in the Australian Colonies, South Africa and elsewhere may note with advantage what has happened.

## Scientific Paradoxes.

The water which drowns us can be walked upon as ice. The bullet which, fired from a musket, carries death, will be harmless if ground to dust before being fired. A crystallized part of the oil of roses, so graceful in its fragrance, a solid at ordinary temperatures, though readily volatile, is a compound substance, containing exactly the same elements, and exactly the same proportions, as the gas with which we light our streets. The tea which we daily drink with benefit and pleasure, produces palpitations, nervous tremblings, and even paralysis, if taken in excess; yet the peculiar organic agent called "theine," to which tea owes its qualities, may be taken by itself (as theine, not tea) without any appreciable effect. The water which will allay our burning thirst augments it when congealed into snow, so that Captain Ross declares the natives of the Arctic regions "prefer enduring the utmost extremity of thirst rather than attempt to assuage it by eating snow." Yet if the snow be melted, it becomes drinkable water. Nevertheless, although if melted before entering the mouth it assuages thirst like other water; when melted in the mouth it has the opposite effect. To render this paradox more striking, we have only to remember that ice, which melts more slowly in the mouth, is very efficient in allaying thirst.—*Sci. Press.*

## Mining Accidents in Great Britain.

From statistics of mining accidents, for year 1881, recently published, it is shown that over one thousand deaths were caused by mining accidents in the United Kingdom. The average is one death to every 454 persons employed; and falls of rock from roofs and sides appear to be the most prolific causes of these disasters.

Coal mining should not have such a record as this in any country—certainly negligence, if not criminal carelessness, is responsible for much of this state of affairs; and the most disturbing thing in connection with the matter is that these disasters increase rather than diminish.

A Grain of iron may be divided into four million parts, and gold may be beaten so fine that it will take 1,360,000 leaves to make an inch in thickness.

THE AMERICAN
GAS LIGHT JOURNAL

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WEDNESDAY, AUGUST 16, 1882.

## Incandescent Lamps and Fire Risks.

The *Scientific American* of Aug. 5th contains the following:

Even the purely incandescent electric lamp is not without its dangers, as was discovered in a Philadelphia drug house a few days ago. One of the strong claims of this method of lighting has been its alleged inability to set anything afire. The nature of the "low tension" current supplying incandescent lamps was thought to forbid the system's ever playing the part of an incendiary, while the security of the lamps was publicly demonstrated by breaking the glowing lamp in the midst of highly inflammable stuffs. Yet, in the case just referred to, a defective lamp came very near starting a serious fire. The lamp was in use in a cellar, and except for the fortunate entrance of an employe, the fire might never have been explained. He found the wires of the lamp—a Maxim lamp—white hot, with their paraffine coating blazing up against the beam and floor above. A well-directed hatchet stroke severed the wires, and the fire was stopped.

An examination showed, according to the statement of Mr. McDevitt, Superintendent of the Insurance Patrol, that of the two wires the one that enters the side of the brass shell below the glass globe in one of the lamps, and which is supposed to be firmly held in place there by a drop of solder, was not in fact so held, but seemed to have been loosely tied to the shell with a bit of copper wire, and to have dropped down from that imperfect fastening, crossing the other wire and establishing electrical connection with it. Both wires were, of course, white hot instantly. They were covered with a heavy insulating coating, mainly composed of paraffine, and that substance burned at once. But for the timely discovery of the accident the entire establishment might have been destroyed. Upon a careful inspection being made of the other lamps on the premises, one or more were found in which the wire was simply tied on, and two others from which the drop of solder had been melted away, or else had never been there, so that the wire was loose and liable to fall at any moment.

Thus we see in one city, and within a few months, each of the types of electric lamps has been the cause of a fire. However safe, as compared with kerosene, the electric lamp will bear watching.

## Large Gas Well.

It is reported that the most powerful gas vein ever struck in Pennsylvania is the one which has recently been tapped and opened up by the Cornplanter Oil Company, of Butler County. The escaping gas is so powerful in volume that its roaring can be distinctly heard at a distance of four miles from the place of vent. The well is owned by Pittsburgh operators, who think they have secured a bonanza. It is their present intention to lay a pipe line to Pittsburgh, where it is proposed to utilize the gas as fuel in rolling mills and furnaces.

ALABASTER CEMENT.—Yellow resin, beeswax, and plaster of paris, equal parts.

## Gas Stocks.

**Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.**
**(with W B Scott & Co.,)**
34 PINE STREET, NEW YORK CITY.

AUGUST 16, 1882.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

| | Capital. | Par. | Bid. | Asked |
|---|---|---|---|---|
| *Gas Co.'s of N. Y. City.* | | | | |
| Central | $466,000 | 50 | 75 | 85 |
| Harlem | 1,800,000 | 50 | 57 | 100x |
| " Bonds | 170,000 | | | 103 |
| Manhattan | 4,000,000 | 50 | 220 | 225 |
| Metropolitan | 2,500,000 | 100 | 180 | 185x |
| " Bonds | 658,000 | .. | 107 | 110 |
| Mutual | 5,000,000 | 100 | 98 | 102 |
| " Bonds, go'd. | 900,000 | 1000 | 100 | 104 |
| Municipal | 1,500,000 | 100 | 190 | 195 |
| " Bonds | 750,000 | | 106 | 110 |
| New York | 4,000,000 | 100 | 117 | 120 |
| Northern | 270,000 | 50 | — | 100 |
| *Gas Co's of Brooklyn.* | | | | |
| Brooklyn | 2,000,000 | 25 | 107 | 1'2 |
| Citizens | 1,200,000 | 20 | 68 | 70 |
| " S. F. Bonds. | 320,000 | 1000 | 105 | 107 |
| Fulton Municipal | 3,600,000 | 100 | 75 | 80 |
| Peoples | 1,000,000 | 10 | 40 | 45 |
| " Bonds | 290,000 | . | 104 | 107 |
| " " | 250,000 | ... | 78 | 90 |
| Metropolitan | 1,000,000 | 100 | 68 | 70 |
| Nassau | 1,000,000 | 25 | 50 | 55 |
| " Ctfs. | 700,000 | 1000 | 93 | 96 |
| Williamsburgh | 1,000,000 | 50 | 57 | 60 |
| " Bonds | 1,000,000 | ... | 100 | 101 |
| Richmond Co., S. I. | 300,000 | 50 | 70 | 75 |
| " Bonds | 40,000 | — | — | — |
| *Out of Town Gas Companies.* | | | | |
| Buffalo Mutual, N.Y | 750,000 | 100 | — | 75 |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Citizens, Newark | 918,000 | 50 | — | — |
| " " Bds. | 124,000 | — | 105 | 10 |
| Chicago Gas Co., Ills | | | 125 | — |
| Cincinnati G. & C. Co. | | | 178 | 180 |
| Consolidated, Balt. | | | 42 | 43 |
| Bonds | | | 107 | — |
| East Boston, Mass | 220,000 | 25 | 122 | 128 |
| Hannibal, Mo | 100,000 | 100 | 95 | 100 |
| Hartford, Conn | 700,000 | 25 | 140 | 144 |
| Halifax N. S | 400,000 | 40 | 148 | 150 |
| Hamilton, Ontario | 153.000 | 40 | 117½ | |
| Jersey City | 750,000 | 20 | 155 | 160 |
| Jacksonville, Ill | 120,000 | 50 | 100 | ... |
| Lewistown Maine | 400,000 | 100 | — | 100 |
| Laclede St Louis Mo. | 1,200,000 | 100 | 117 | — |
| Montreal, Canada | 2,000,000 | 100 | 168 | 170 |
| New Haven, Conn | | 25 | 132 | — |
| Oakland, Cal | | | 32 | 33 |
| Peoples, Jersey City | | ... | 75 | 80 |
| " " Bds. | | | ... | ... |
| Pittsfield, Mass | | | 120 | 130 |
| Rochester, N. Y | | 50 | 70 | 80 |
| Wilmington, Del | | 50 | 174 | ... |
| Yonkers | | 50 | 30 | 32 |
| St. Louis Missouri | 600,000 | 50 | 250 | 254 |
| San Francisco Gas-Co., S. Fr'isco Cal. | | | 68 | 69 |
| Toledo, Ohio | | | 95 | 97 |
| Troy, Citizens | 600,000 | 100 | — | — |
| Washington, D. C | 1,500,000 | 20 | 185 | 200 |
| " Scrip | 375,000 | 15 | 200 | 206 |

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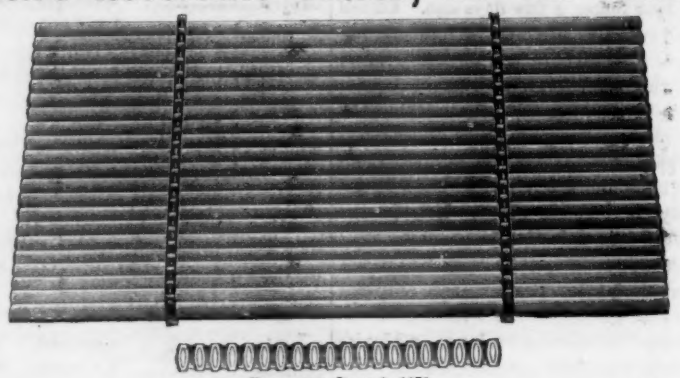

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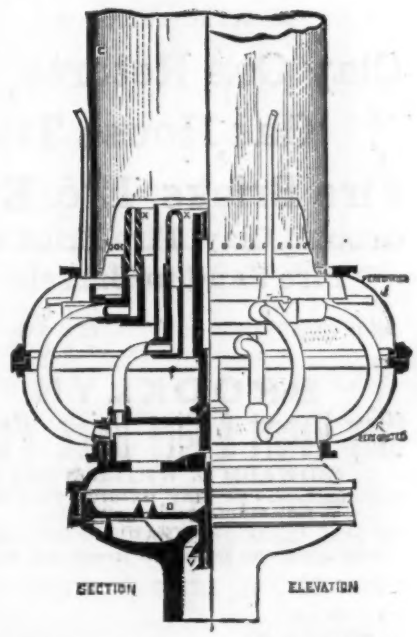
| C (21 " ) | 14 | JJ (38 " ) | 30½ |
| D (24 " ) | 16 | K (42 " ) | 31 |
| E (27 " ) | 18 | KK (42 " ) | 34 |
| F (30 " ) | 20 | NN (75 " 2 rings) | 50 |
| G (33 " ) | 24 | 100 Candles (2 rings) | 100 |
| GG (33 " ) | 25½ | 200 " (3 " ) | 200 |
| H (36 " ) | 28 | 400 " (4 " ) | 400 |

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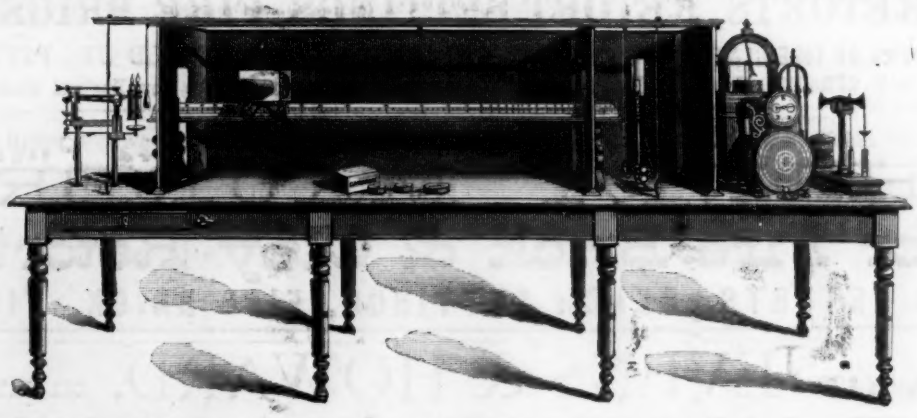

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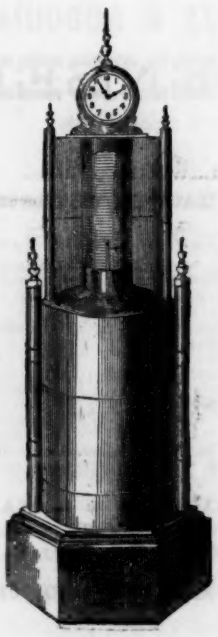

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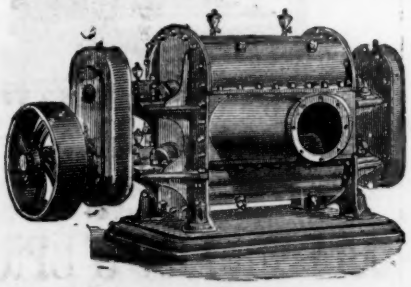

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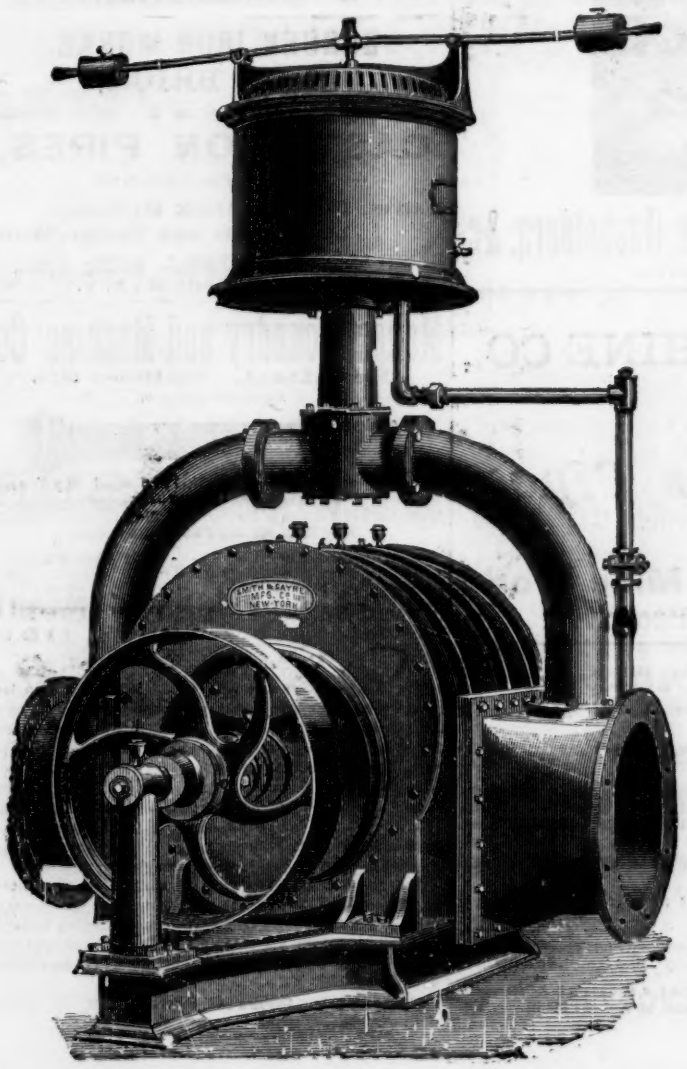

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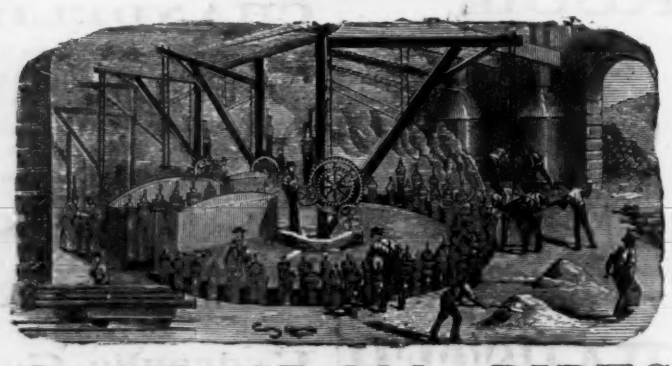

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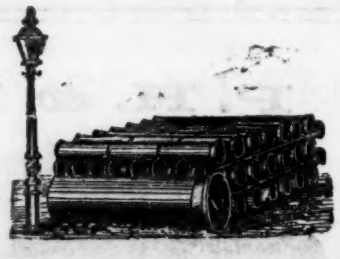

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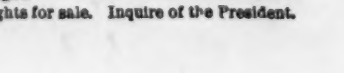

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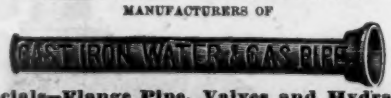


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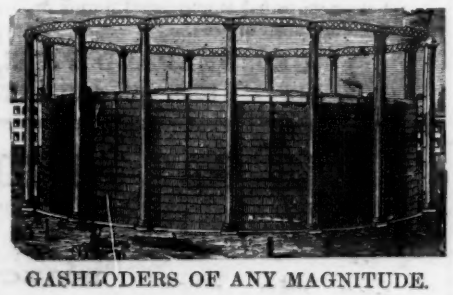

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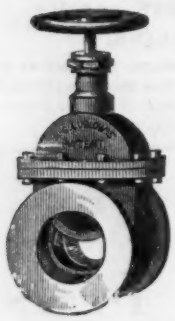

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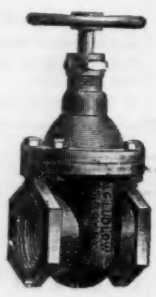

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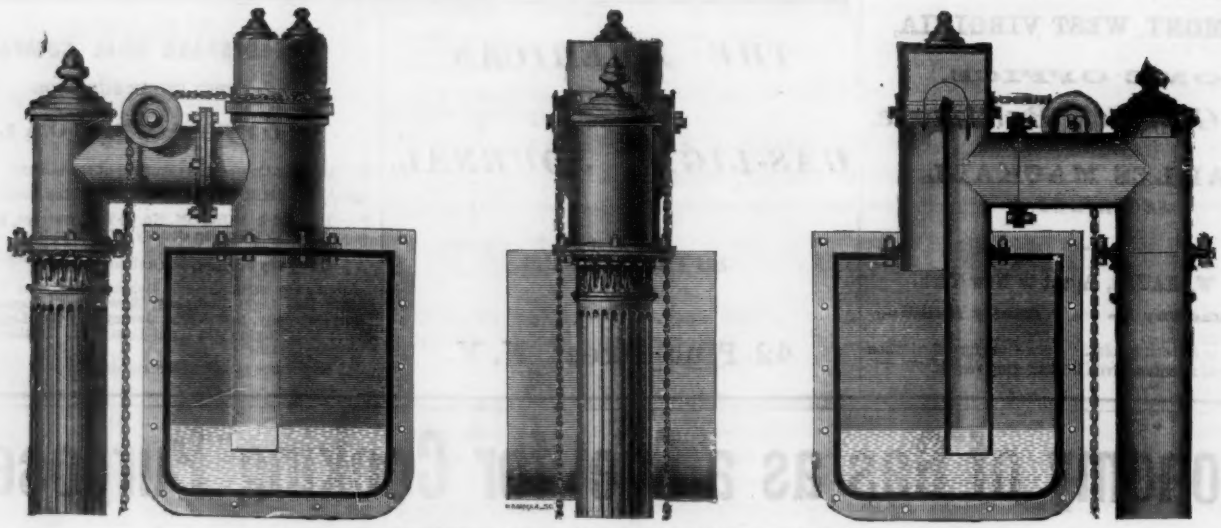

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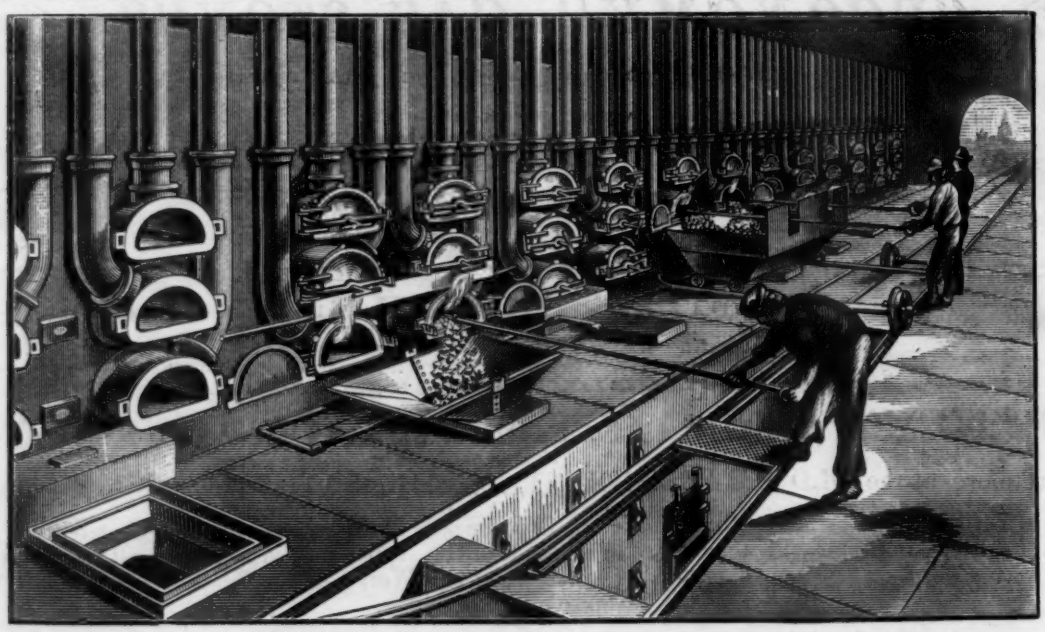

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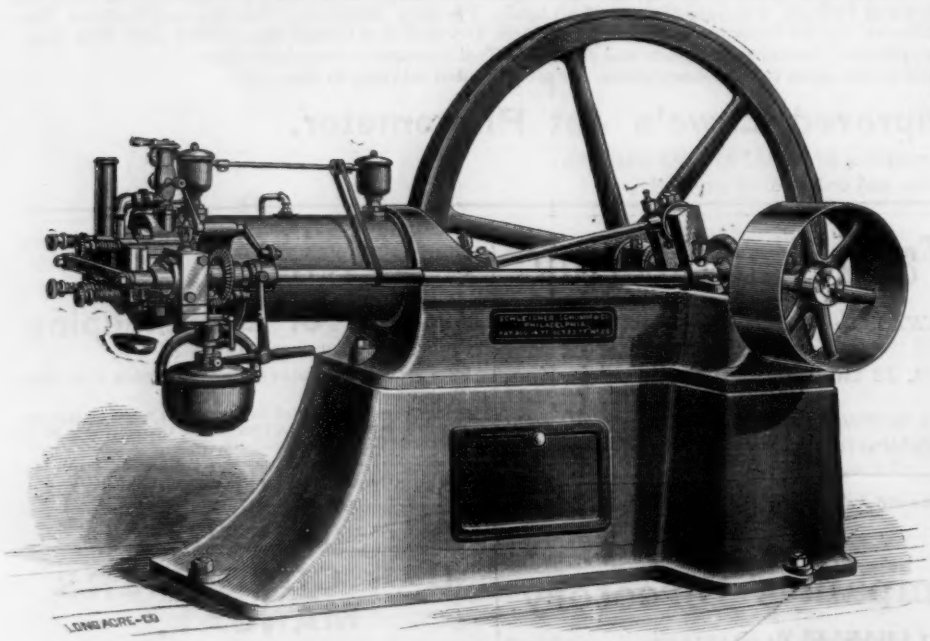

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